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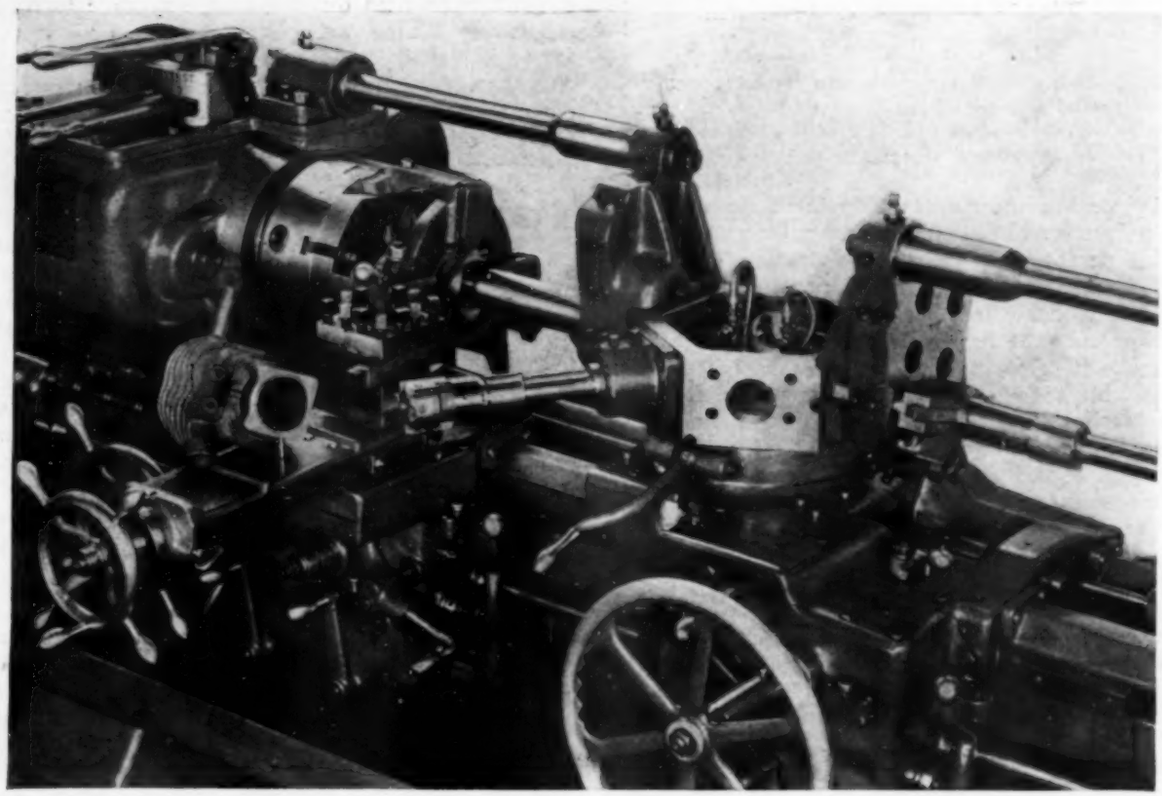


Fig. 1—The cost of tooling for this air-cooled motor was saved more than three times by the decreased machining time

Turret Tooling with Carbide

M. E. LANGE

Production Engineer, The Warner & Swasey Company

In the many pro and con discussions of carbide tools, specific cost data have only too often been lacking. The author fills this deficiency so far as the turret lathe is concerned with several carefully prepared comparative analyses

WHEN cemented tungsten carbide was first introduced, it was hailed as the universal panacea for all machining troubles when cutting metals or most any other substance. The most spectacular initial demonstrations showed the cutting of materials which had such great hardness, or possessed such abnormal abrasive action, that no satisfactory method for machining them had been known before. But the average machine shop is most vitally interested in machining cast iron, steel, and certain non-ferrous metals. After the first wave of enthusiasm concerning the possibilities of tungsten carbide in this field had passed, it was discovered that certain qualifications concerning the use of this new material were decidedly in order.

First, there was raised the cry that practically all existing machine tools would be obsoleted. Secondly, in spite of satisfactory experimental results soon reported on cast iron and the non-ferrous metals, the high purchase price of the new cutters commanded a careful study of all the facts and the application of new methods of control before individual or group installations could be justified. Much important groundwork has been

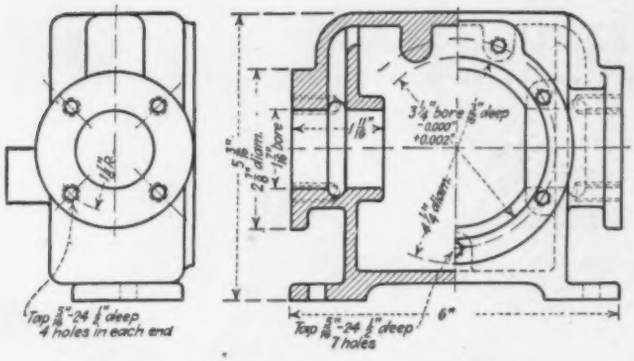


Fig. 2—This refrigerator crank case of nickel cast iron proved a good subject for carbide tools. A saving of two hundred and sixty dollars was made on an investment of seventy-three dollars

covered since, but unfortunately, the low state of activity of our industry makes it difficult to gather even a few time-tried performance cases. This article deals with some facts concerning this development in the field of turret lathe tooling.

The first and quite serious question of almost universal obsolescence of existing machine tools has fortunately not been able to stand. Although it was a fact that carbide applications required great power and rigid design of the machine tool for the mounting of these new cutters, it was also soon established that machine tools of comparatively recent design were capable of using the new cutters on a profitable basis, making obsolete types only which would soon have been on the replacement list anyway.

The second question involves the use of carbide cutters in cases where, through comparison with other successfully operating jobs, satisfactory production performance can be predicted as far as speed, feed, and accuracy of the job is concerned, but where the high cost of cutters makes it necessary to raise the question, "Does it pay?" Into this group of work falls a large proportion of the average cast iron and non-ferrous metal production jobs encountered in the bulk of production and job shops in this country.

Dividing the production field roughly into two groups, we have to deal with the quantity lot and the small lot jobs. In both of these, the turret lathe has offered many opportunities to use profitably carbide installations. The turret lathe is a versatile machine tool in which many different types of operations can be performed. Some of these do not lend themselves as yet to satisfactory application for carbide cutters. Threading dies and taps for instance, as well as most of the reaming tools, fall into this group. On the other hand, when advantage is fully taken of the principle of "combined cuts" and "multiple tooling" ("Modern Tooling Methods for Turret Lathes" by M. E. Lange), large and small diameters are often being machined at the same time. The possibility suggests itself of using carbide cutters on the largest diameters, finishing the smaller diameter sizes with high-speed steel cutters. Thus the more expensive cutting material is only applied where it can be used most profitably.

The several makers of tungsten carbide have supplied the trade with a group of standard shapes of cutters which can be used directly on the average turret lathe job for machining cast iron, aluminum, or bronze. As far as the small lot field is concerned, it would be difficult to go beyond the use of these standard shapes without showing red figures in the production cost statement. On the other hand, there are opportunities for using special cutter shapes profitably in quantity production work if the product is not changed in design before the cutter is used up.

When considering the value of carbide applications for a given set of conditions, there must be taken into consideration first the initial purchase price of the cutters. Secondly, the grinding cost is of importance. Unless a special expert grinder hand is carefully trained to sharpen these cutters, an excessive amount of valuable metal can easily be ground away in several grinds, where ten times as many grinds perhaps should have been possible. Into this category incidentally also falls the need for instruction and control as to when the cutter should be returned for grinding so that it is resharpened at the most economical time in its process of becoming dulled on the job.

Reduced Down Time

Thirdly, a factor enters the field which at times is but little recognized as yet, but which may often influence production costs considerably. The longer life between grinds of carbide cutters, when compared with that of high-speed steel, will often reduce the down time or set-up time allowance on a given job by a considerable amount. There are numerous cases on record where a somewhat slower speed and a resulting considerably lengthened cutter life between grinds established the most economical combination. Lastly, an allowance must be made in the profits statement for occasional damage to carbide cutters through misuse. Several typical turret lathe installations are outlined in detail below.

Fig. 3—By means of an indexing fixture, three sides of the castings are machined in one chucking. This includes drilling the holes

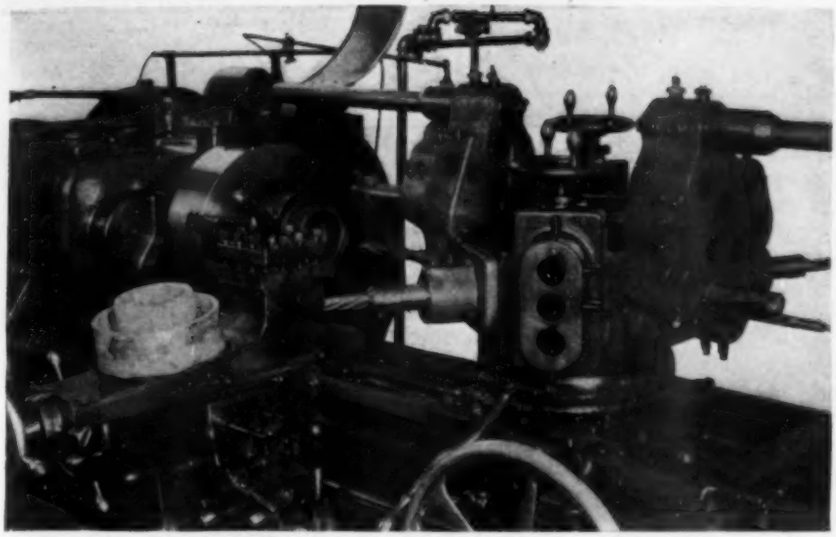


Fig. 5 — Standard tool shapes are employed in the pulleys shown in Fig. 4. Because of the limited lots, the cost of special cutters would not be warranted

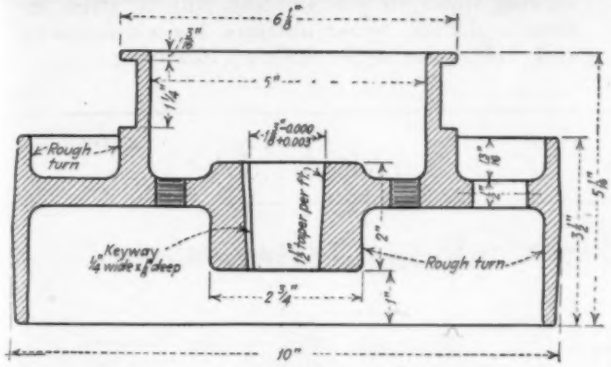


Fig. 4—These cast-iron pulleys are made in lots of 50. $8.45 is saved on each lot through the gain in time from carbide tooling

The first operation of the air-cooled motor cylinder shown in Fig. 1 is being completed on a 1A Warner & Swasey turret lathe. It is a quantity production installation. In this particular instance the machine, however, is not used continuously on only one job. Carbide cutters were used to advantage on the entire job, excepting that the reamer blades were made of high-speed steel. A comparison of past and present performance of finishing this job brings out the following conclusions:

Purchase price of one set of 9 carbide cutters	$226.00
Average grinding time—70 min. for 9 cutters	
Total grinding cost for the full cutter life of 60 grinds of all cutters at 2½ cents per minute	105.00
Allowance for accidental cutter damage	17.00
Total expense for carbide cutters	$348.00

Similarly, a sufficient number of the previously used cutters to machine the same quantity of cylinders produced with a set of carbide cutters, plus the grinding time required for these, requires an expenditure of $87.00; hence the added expense required for the use of carbide cutters is $261.00, and this expenditure must be justified by the saving through higher production.

Production time carbide cutters, 11 per hour	5.5 minutes each
Former production time, 8 per hour	7.7 minutes each
Gain in production time	2.2 minutes each

With labor plus overhead figured conservatively at 2½ cents per minute ($0.60 labor and $0.90 overhead) the saving amounts to 2.2 minutes × 2½ cents per minute = $0.055 per cylinder.

With an output per hour of eleven castings, an average cutter life between grinds of three days, or twenty-four working hours, and a total cutter life of sixty grinds, an approximate number of 16,000 castings can be machined with the one set of carbide cutters. This amount represents about a year's requirements, and the machine will be active on this one job for a period of about 180 days. The savings possible, therefore, amount to 16,000 × $0.055 = $880.00. Deducting 6 per cent interest on the investment for the time of the cutter life (one year in this case) leaves a net saving of $880.00 minus $15.66 = $864.34. Since the additional investment required to bring about this saving is $261.00, the profit yield is at the rate of 331 per cent.

In Figs. 2 and 3 are shown the working drawing and the turret lathe with tools for a compressor crankcase made of cast iron. This installation is a quantity production job, and the turret lathe is used continuously for this work only.

All three sides of this casting are being machined in one chucking, using an indexing fixture. The holes drilled into the three faces, four each in the two small flanges, and seven in the large diameter face, are also drilled on the turret lathe before the casting is removed from the fixture. The two multiple drilling heads rotate with the fixture by means of two driving pilots. The tools on the hexagon turret are equipped with high-speed steel cutters, but the facing cutters on the square turret are made of tungsten carbide.

The additional investment required over the cost of slower speed cutters on this job is $73.60 for carbide cutters, and during their life they earn an amount of $261.00 or 354 per cent.

A Cast-iron Pulley

The cast-iron pulley shown in Fig. 4 is produced in lots of fifty, six times a year, and the first operation is a turret lathe job. The Warner & Swasey 3A turret lathe used for this work is a general-purpose machine on which a number of small-lot jobs, such as various sizes of pulleys and other cast-iron parts, are being finished. The standard tools are arranged in a permanent set-up around the hexagon turret. The setting-up work required for individual jobs consists of exchanging shanked tools, the clamping of the cutters in the square turret, and the setting of the machine stops. For this reason, it is necessary at times to use the turret tools in a different order from the one in which they are arranged around the turret. This condition is quite permissible, as the time required for back indexing is

scarcely greater than that needed for using the tools in the order of their mounting.

Fig. 5 shows the turret lathe with the tooling set-up for machining this pulley. Four carbide cutters are mounted in the square turret and two on the hexagon turret, one for rough turning the O.D. and the other for boring the large I.D. The taper attachment of the square turret cross slide carries a radius contour plate for producing the crown of the pulley.

The profit statement for this job works out as follows:

Purchase price of one set of 6 carbide cutters, including breakage allowance	$152.90	
Cost of carbide cutters for this job, with a total cutter life of sixty grinds, and one grind required is 1/60 of $152.90, or	2.55	
Average cost of one grind per set of six cutters @ 2½c. per minute	1.50	
Total carbide cutter cost for this job		$4.05
Purchase price of previously used cutters	46.00	
Cost of these cutters for this job, with total cutter life of 100 grinds and two grinds required is 1/50 of $46.00 equals	0.92	
Average cost of two grinds per set of six cutters @ 2½c. per minute	1.25	
Total cost of these cutters for this job		$2.17
Additional investment required for carbide cutters		$1.88
Previous production time	0.472 hours	
Production time with carbide cutters	0.359 hours	
Gain in production time	0.113 hours	
With labor plus overhead @ $1.50 per hour, saving per piece	$0.169	
Saving per lot of 50 pieces	8.45	

Hence, with an additional investment of $1.88 for carbide cutters a saving results of $8.45. The profit yield in this case is at the rate of 449 per cent on the investment.

Use Standard Carbide Cutters

Since a varied number of parts is to be produced on this turret lathe in lots of 50 pieces, it would be prohibitive to use anything but plain and standard catalog shapes of carbide cutters so that they can be used over and over again on different jobs. In addition, it has been found necessary to instruct carefully the tool supervisor, the grinder hand, as well as the foreman and the operator so that the cutters are only used in those cases where the existing shape of the cutting edge suits the job exactly "as is." Any amount of altering of the cutting edge requires so much grinding time and the metal ground off is so costly that any other procedure is suicidal from a cost point of view. It has been found profitable in many organizations to appoint some one specific person who sees to it that these orders are strictly adhered to. When this is done, these carbide cutters can be profitably used on turret lathes, even in small-lot production work.

• NEXT WEEK •

What the dealer thinks about guaranteed production estimates is told in an illuminating article by R. L. Giebel under the title, "One Customer Pays for Service to Ten." An old contributor, C. W. Hinman, describes how nickel parts are automatically curled, joined, and seamed at the rate of 125 per minute.

Housed in inadequate quarters, one tool manufacturer dreamed of an ideal small shop. How depression prices made this dream an actuality is described by word and picture. Oliver P. Van Steewen tells of "A New Measuring Machine."

A unique swaging process for forming converging holes in gas welding tips is given in detail. Harry Shaw outlines his experiences and difficu'ties in burnishing bearings.

• IN A. M. •

Saving a Large Gear

JOHN THOMAS

SEVERAL years ago, while cutting teeth on a large cast steel gear of 224 teeth, 2 C.P., 10-in. face. approximately 12 feet in diameter, the operator noticed an unusual amount of smoke and chatter. Stopping the machine to investigate, he found that the cutter had evidently cut through a small sand pocket in the casting soon after the start. One side of the cutter was pretty badly used up.

About this time, someone else had the idea that probably the gear had shifted on the arbor because of the unbalanced side pressure and chatter. Going back and indexing over the finished teeth, it was found that the center of the last tooth was about $\frac{3}{16}$ in. (0.1875) short of where it should have been.

Further investigation showed that fortunately the shift had been fairly uniform. While the total was something to worry about the actual variation between any two teeth was not appreciable, and all in the same direction.

To continue the cutting as the gear stood was out of the question as we would surely wind up with the last tooth $\frac{3}{16}$ in. thick. The casting and labor so far represented several hundred dollars, so some means of saving the gear was decidedly in order.

We still had 105 teeth to cut, and the only apparent solution seemed to be to distribute the $\frac{3}{16}$ in. uniformly among the 105 teeth, that is, the pitch of the remaining teeth would have to be stretched so as to take up the error of $\frac{3}{16}$ in.

The length of that part of the pitch circle still to be cut would be:

105 × 2 in. =	210.000 in.
Plus the error of	0.1875 in.
	210.1875 in.

and the necessary C.P. to cover this space would be:

$$\frac{210.1875}{105} = 2.00178 \text{ in.}$$

As our whole pitch circle was 448 in. (224 × 2), in order to produce the pitch required (2.00178 in.), the machine would have to be geared up to index:

$$\frac{448}{2.00178} = 223.8008 + \text{teeth}$$

instead of 224.

The divide gear formula was:

$$\frac{24}{\text{Number of teeth to be cut}} = \text{ratio} = \frac{a \times b}{c \times d} = \frac{\text{drivers}}{\text{driven}}$$

Substituting we have:

$$\frac{24}{223.8008} = R = 0.10723822 +$$

The calculations necessary to find the index gears are omitted as the method used has been fully explained (*AM*—Vol. 74, pages 403 and 943; Vol. 75, page 601; Vol. 76, page 136).

The index gears used were:

$$\frac{754}{7031} = \frac{26 \times 29}{89 \times 79} = R = 0.10723937$$

Original ratio desired = 0.10723822

Error = 0.00000115

These gears will index:

$$\frac{24}{0.10723937} = 223.7984 \text{ teeth}$$

Desired number of teeth to be indexed = 223.8008

Actual index = 223.7984

Difference = 0.0024

Actual error in indexing full circle = 0.0024 of one pitch, reducing to inches

$$0.0024 \times 2 = 0.0048$$

Actual error in inches at end of cutting 105 teeth

$$= \frac{0.0048}{223.7984} \times 105 = 0.0021 \text{ in.}$$

While this gear was not cut exactly according to Hoyle, nothing unusual could be detected when it was put into service.

A Part *and the* Prize-Winning Jig *for It*

Discussion

J. A. POTTER
Chief Draftsman, Bridgeport Plant, Singer Manufacturing Co.

REGARDING the interesting article under the above title (*AM*—Vol. 76, p. 362), several practical questions come to mind. It appears that the problem can be handled in three or four different ways and is not in accord with present-day manufacturing methods. Apparently all holes are to be drilled, reamed, tapped, or counterbored in one jig. This would obviously require ten spindles with different feeds and speeds.

Holes in the hub and web of the part are fairly large. Why not, therefore, make one jig for these holes, with a bushing in the opposite wall for pilot reaming the larger hole, with suitable provision for taking up thrust while drilling? This jig would be cheap, could be used on a larger drill press with heavier feed, and would require only a three-spindle machine. A second jig of much lighter construction could then be used for the smaller holes. The part might be redesigned to have the same size counterbore at the binding-screw hole and the two holes in the base. This would only require one six-spindle gang drill for the job, and the two simpler jigs would be almost as cheap as the one illustrated, would avoid part of the chip problem, would load and unload more rapidly, and could be used at correct drill speeds.

From our point of view, other considerations would enter into the design and layout of tools for such a part. How and where is it to be used, how many parts are required, and similar questions come to mind. Possibly it might be better to drill and ream the large hole in a lathe using a two-jaw chuck or fixture, milling in the succeeding operation, and finally drilling the smaller holes. This method would at least give the advantage of a longer surface with which to square up the work, a point which most tool designers should consider.

Let us reconsider the design of the jig as illustrated. Here are a few items that are possibly open to criticism: Knurls hurt the fingers of operator and slow down production; Bushings are not put in a leaf that is used to bind the work; Clearance holes should be put in bottom of the jig so that it can be slushed in a soda kettle to free from chips, if desired; The resting plate on bottom should be held down by screws, not drawn down; Lining bushings should have shoulders and slip bushings should have a step so they can be removed readily through use of a screw driver; Slip bushings should also be locked from turning; The hole in the web could have been drilled from opposite side and a shorter bushing used.

There will be considerable thrust when drilling the large hole, even if it is cored and a hog drill is used. Therefore, it would be advisable to use a jack screw or spring plunger to overcome the thrust. The leaf could be notched over the counterbored holes for the base, thereby allowing direct insertion of the counterbore. The leaf could have been made longer on the hinge-pin side by building out two lugs on the wall of the jig, thereby making the hinge pin shorter and easier to bore without weakening the jig wall. Jigs for small holes should be made light. Since this is a simple box-type jig, why not modernize it through use of hot-rolled steel, cutting torch and arc welding?

Let it not be assumed that we consider everything is wrong about the jig and the competition which produced it. The research of the American Machinery & Tools Institute is to be commended, and its work is certainly doing much to advance jig and fixture design. We believe, however, that future competitions should consider some of these points.

EXECUTIVE FORUM

New Brooms

Most readers have witnessed sweeping changes made in plant personnel when things are not meeting the expectations of the management. This action is a familiar practice in manufacturing plants. Sometimes the result is to put those affected on their toes in an endeavor to make a good showing with their new responsibilities. But does such a policy have a lasting beneficial effect? Does it really cure the difficulties it undertakes to correct? Or is it simply a shotgun method of attack employed as a substitute for more specific remedy? What do you think about this problem?

ESCORTED by his friend, Al Kendall, works manager of the Planet Engine Company, Bill Holland picked his way among the castings on the shop floor. The Planet shop was not new to Bill, for he had been through it a number of times before. Occasionally he exchanged greetings with one of the foremen but noticed that many of them were in new locations.

"I want you to meet our new superintendent," said Kendall as their jaunt brought them opposite the shop office. "You probably remember John Tompkins, our boring mill boss. He's running the shop now."

"What became of Fred Hastings?" asked Bill. "I thought he was one of the best in the business."

"He was," said Kendall. "But you know how it is when business is slack. Things begin to slow up, and there is danger of everyone's settling into a rut. I had Fred sent out to the Cleveland Office as factory representative and promoted John to the superintendent's job."

"You lost a good superintendent," said Bill, somewhat puzzled, "and then you had to find a new boring mill foreman."

"I put the toolroom foreman on that job," said Kendall, "and my lathe boss in charge of the toolroom. Before I was through I had half the shop switched around."

"What did you gain?" asked Bill. "You took men off jobs in which they were experienced and gave them work with which they were not familiar. I wouldn't call that improving efficiency."

"But it has," said Kendall. "There's nothing like a change of scenery for putting a man on his mettle. Of course, most of them objected at first. Fred Hastings, for example, kicked like a steer on having to move to Cleveland. But after the first flurry they all quieted down."

"When did you do all this?" asked Bill.

"Just a week ago," said Kendall. "You'd be surprised how they go after their new duties. I'm so well pleased that I'm considering shaking up the rest of the crowd. You know a new broom sweeps clean."

"Go easy," Bill cautioned. "I don't doubt that your move has put these men on their toes, but after the novelty has worn off, where's the advantage?"

"For one thing it will give these men a more diversified experience," said Kendall. "That will make for a more flexible force. Then if any vacancies occur through a man's leaving or through illness we won't be up against it entirely."

"You can guard against that by having an understudy for each man," said Bill. "It looks to me as though you are following the time-honored practice of a general shake-up that's often used when profits begin to drop. In the long-run you'll find that you're losing some of the detailed experience these men acquired in their old jobs. When business picks up you'll wonder what's wrong."

"On the contrary, I believe a man is more alert for new ideas when confronted with new problems. Already some of the foremen have come out with suggestions on how they can improve things. At least this shows they are taking an increased interest in their work."

"You'd do better," said Bill, "to look for the basic causes of lost efficiency. Instead of that, you're merely stirring up your organization in hopes that your new set-up will be an improvement over the old."

Discussions Of Former Subjects

Turning Backward

Intense mechanization is the principal source of the present depression but the progress of mechanization cannot be stopped, nor can we turn backward and resort to the simpler handicraft of yesterday. The only thing to do is to bring production under control.

We have a producing capacity far in excess of our consuming capacity. The consuming capacity depends upon buying power, desire to buy, and ability to consume. Consuming ability requires both buying power and leisure time.

Production control can be obtained by reducing the number of weekly working hours to such an extent that employment will be created for all. This will increase buying power and give more leisure time for consuming. This has been proven because 50 years ago people worked longer hours with less pay than they do today. —ALFRED LOEFFLER.

Itemized Pricing

The idea of a separate service charge for new machinery has much to recommend it, not only from the selling viewpoint, but also from the buyers' angle. It is well known that at least five per cent of the cost of modern machinery comes under the heading of service, yet in many cases, more especially where the buyer has a well equipped maintenance and erecting department, the service charge would be negligible under a scheme of itemized pricing. The saving, thus accomplished, would enable the machine to be more attractively priced, with resultant benefit to both parties.

On the other hand, machine tool buyers have become so accustomed to the benefits of unlimited service, it would require considerable education to convince most of them that itemized pricing was not an ingenious means of depriving them of something they had a right to expect. To break the news gently, it would probably be necessary to modify the plan, whereby a fixed sum would be allowed by the makers of a machine, representing man-hours and expenses for service, anything over that to be chargeable to the buyer.

At the same time, the present plan of unlimited service creates a bond of goodwill that often bears fruit in repeat orders. It is rather open to question whether the same spirit would prevail if that service had to be paid for directly by the purchaser.

—ROBERT S. ALEXANDER, *Universal Winding Company.*

When purchasing new machines, the buyer often has to pay for what he does not want. Some buyers can sum up a machine's capabilities and work a machine with a minimum of expense and demonstration from the seller. Others are the reverse. Good buyers of the first class are those who employ highly skilled operators who can be trusted to get the best out of any machine. The second class are those who employ indifferent labor, and require the machines to make up for inefficiency.

For years, it has been the practice for machinery buyers to receive free service from the seller, except in cases of inferior machines sold at cut prices. On the other hand, this makes the machine dearer and drives many competent buyers to the second-hand market where there is no service.

I would suggest one price for the machine as it stands, this to include the guarantee and the ordinary cost of selling. Additional service, such as training operators, extra demonstrations at the buyer's works, and visits of skilled mechanics to adjust the machines should be charged for extra at cost price.

—W. E. WARNER, *Herts, England.*

Stockholder vs. Employee

No matter what the duty of management may have been in the past, that part of society which is represented by capitalism is up against the present and finds that the right to employ implies the responsibility to keep employed.

The result of industries having been developed to what they are today is that employees are not so free to move about, to change occupations, or even to say at what age they shall begin or quit working. Stockholders on the other hand are free to invest or withdraw, to change from one type of investment to another, and may do these things at any time of their lives. To say that one or the other must make all the sacrifice is manifestly unfair, but with certain individual exceptions, the stockholder is in a position to take the bigger loss. Any management that is not working for both stockholders and employees in these and future days is going to find itself working for nobody.

The reluctance to dig into surplus is a most inconsistent attitude. All during the prosperous years when surpluses were being accumulated, finance and management were busy telling the employees to also acquire surpluses to fall back upon when the inevitable rainy day arrived. Labor, being either out of work or on a reduced income, is being forced to dig into its surplus. Have the stockholders a divine right to be exempt from doing the same?

—H. D. MURPHY.

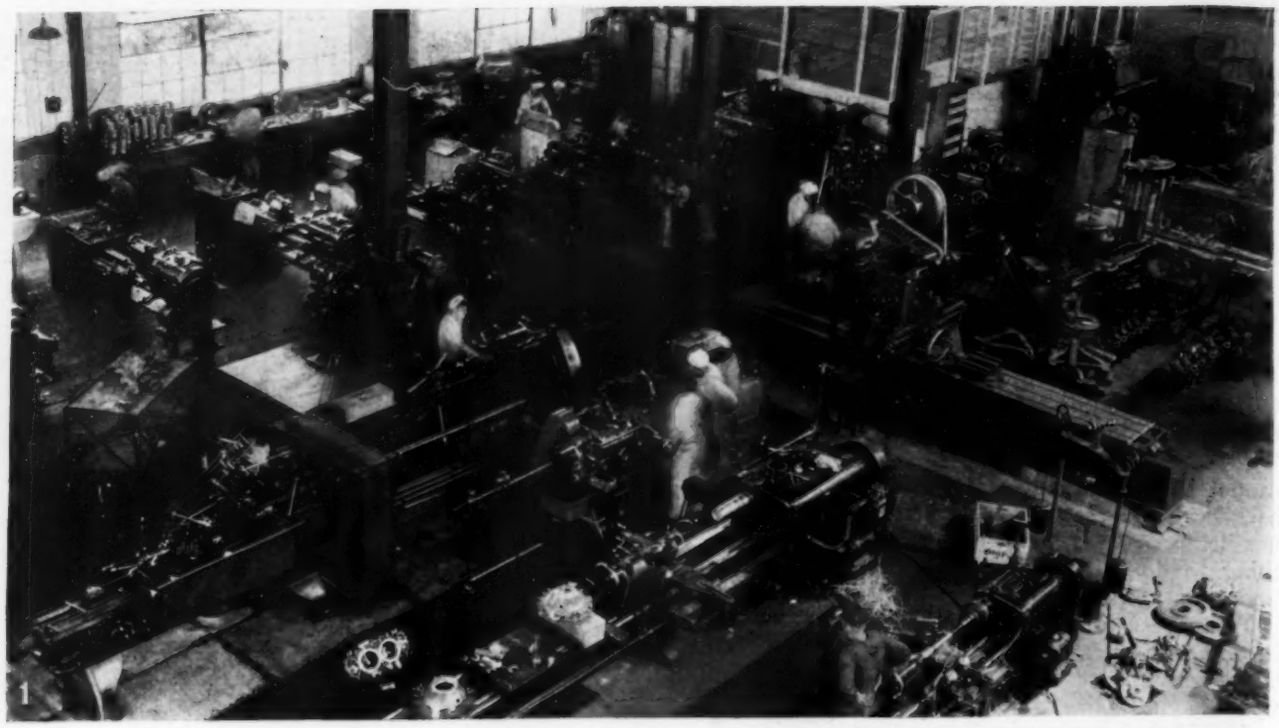
The Up Grade

My vote for the selection of assistant shop superintendent goes to Jim Boyle. Ned Reynolds' technical experience will stand him in good stead in any position, such as timestudy, rate fixing, purchasing, accountancy, engineering, apparatus design, or sales. Should he excel in any of these, he will be of value to his company.

To fill the position of superintendent or his assistant, it is absolutely necessary that the candidate have a practical training in toolmaking and design, thus obtaining a thorough grasp of production methods. Jim Boyle has graduated as a successful toolmaker and passed on to milling departmental foreman. His seven years of practical experience puts him four years ahead of Ned in knowing how to handle machines, methods, and men. Furthermore, Jim has a whole lot of technical knowledge under his hat, or he could not have been a successful toolmaker. Without doubt, he studied at evening classes during his term of apprenticeship, and right now, he continues to keep abreast of modern methods and equipment.

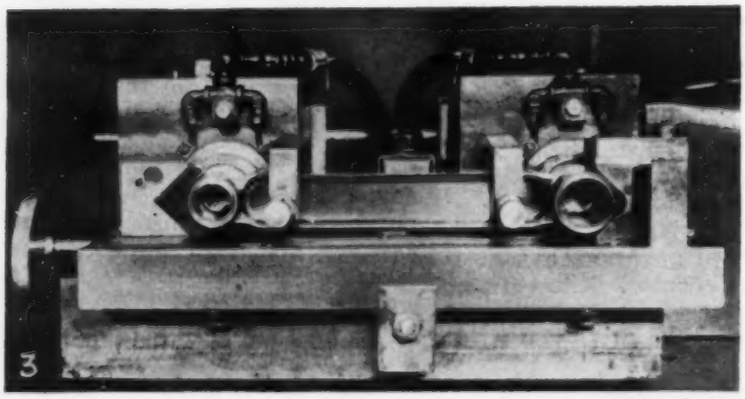
To my mind, the technically trained man is unable to tackle the daily problems that occur in the fabrication of engineering products in the shop unless he has had at least one year of practical experience in the toolroom.

—C. L. MILLAR, *Beeston, England.*



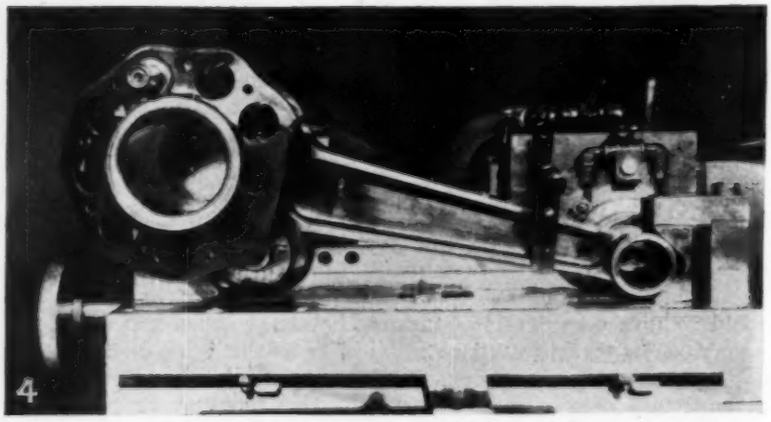
[1] Good tool layout and crane service for larger machines speed engine repair

Keeping Navy Aircraft Engines in Trim

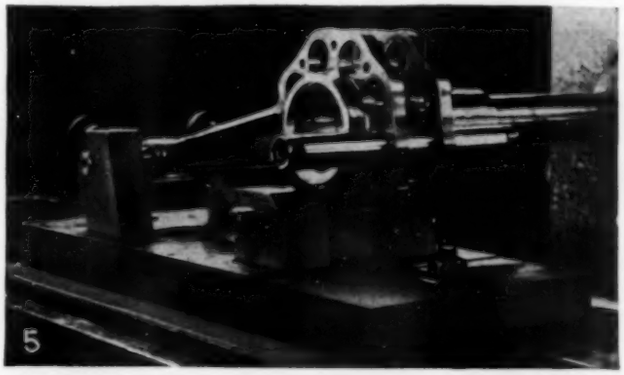


Possibly even more difficult than construction is maintenance of aircraft engines. Three pages of pictures here show typical steps in repairing engines at the Navy shop, North Island, Coronado, Calif.

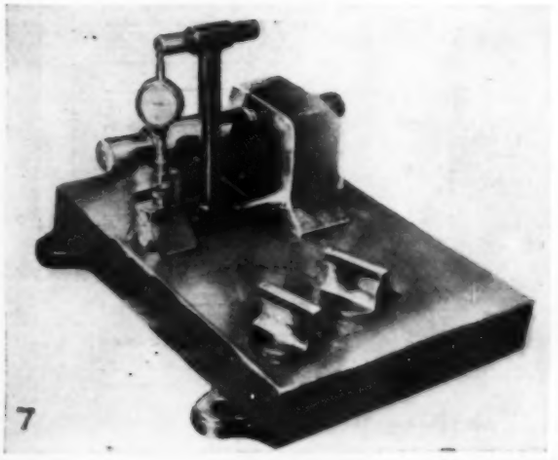
Reboring connecting rod bearings involves accurate locating, centering and secure clamping without distortion. A special rod boring machine is used, a portion of the front being shown in Fig. 3. Both tool heads are driven from the same motor. Auxiliary rods are held in a pair of V-blocks and clamped with C-clamps. Both blocks and spindle heads are adjustable. Air jets remove chips. Cutters are tipped with Firthite and remove about 0.002 in. The same unit boring small ends of master rods is shown in Fig. 4. The large end of the rod is supported by one block between the flanges while the other block positions the rod. Alignment is checked by surface gage from a standard plug extending through one of the upper auxiliary pin holes



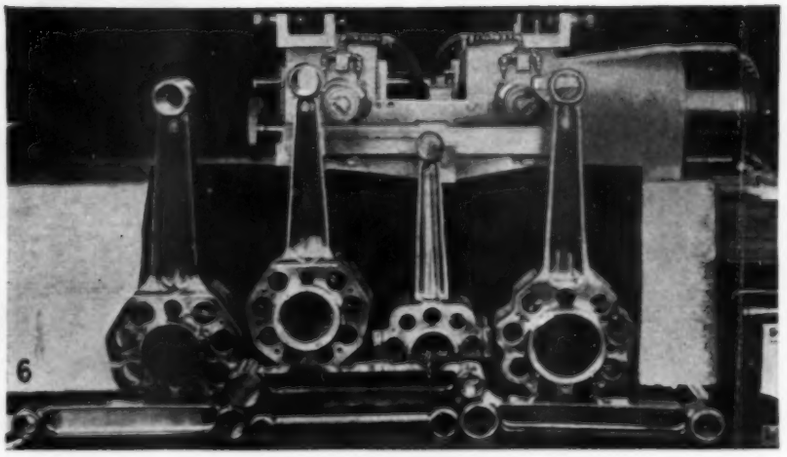
[2] A central bench with abutting wing benches form a series of small bays in the motor assembly department. In each bay an assembling stand is placed



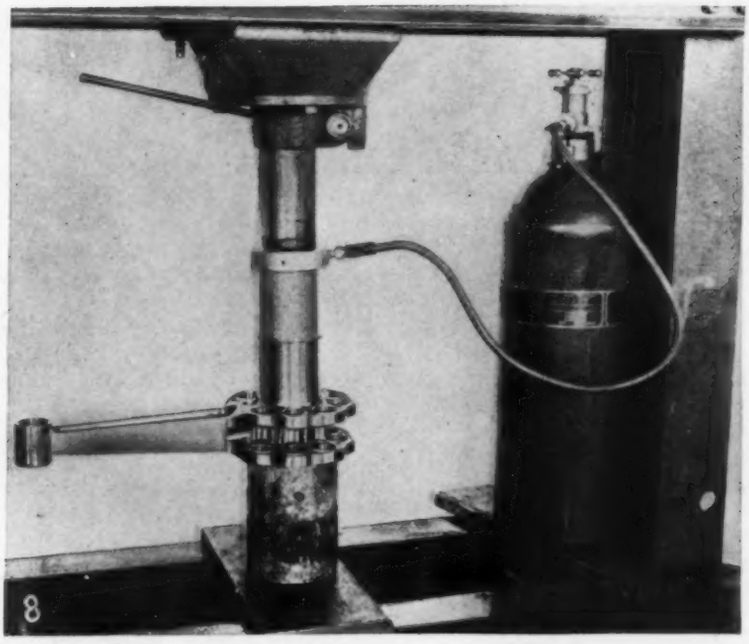
[5] The fixture for reboring bushings for the large ends of connecting rods. Vertical V-blocks clamp a plug in the small-end bearing while the large end is clamped in jaws. Position and parallelism are checked by surface gage on the through plug shown. Cutters remove about 0.002 in.



[7] Fixture for checking alignment of the holes after reboring. The heavy block at left supports two bars of different diameter but parallel. Two adjustable parallels at right complete the unit. Connecting rods set in are checked with plugs and a dial indicator mounted on a V-block



[6] Proper action of the chip-clearing air jets involves careful attention to their location and their air connections. The motor drive and a variety of the rods rebored on this special machine may be seen



Distortion of the thin master rod when the bushing is inserted might occur were conventional shrink-fit methods used. H. P. Morris therefore devised an apparatus that shrinks the bushing by cooling it, then allows it to expand in place. Details of its construction are shown in the drawing of Fig. 9. The device is used in a hand-operated press built up of structural shapes. The rod is supported in a sleeve, the bushing slipped over a perforated sleeve connected with a tank of compressed CO_2 gas, which when released solidifies within the bushing, shrinking it temporarily. It is shown in use in Fig. 8 to insert a bushing, in Fig. 9 to remove one. Rods are usually heated to 350 deg. F. beforehand to increase the temperature difference. Valve guides are similarly applied and removed.

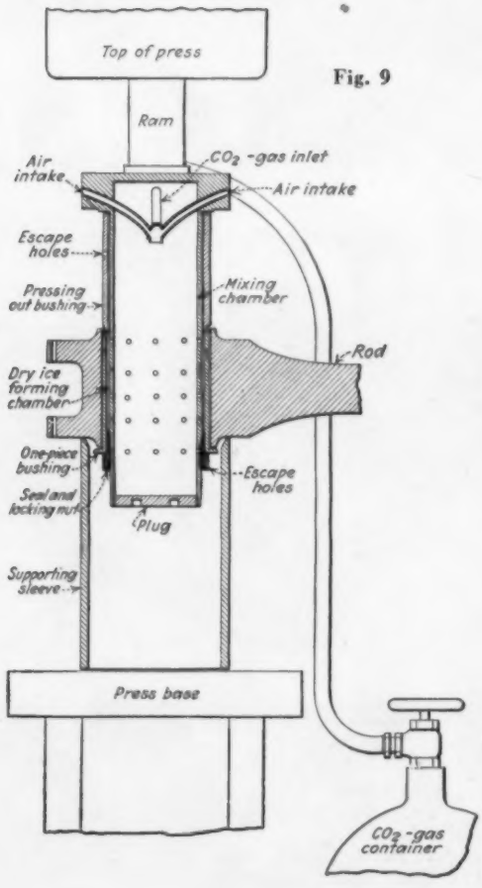
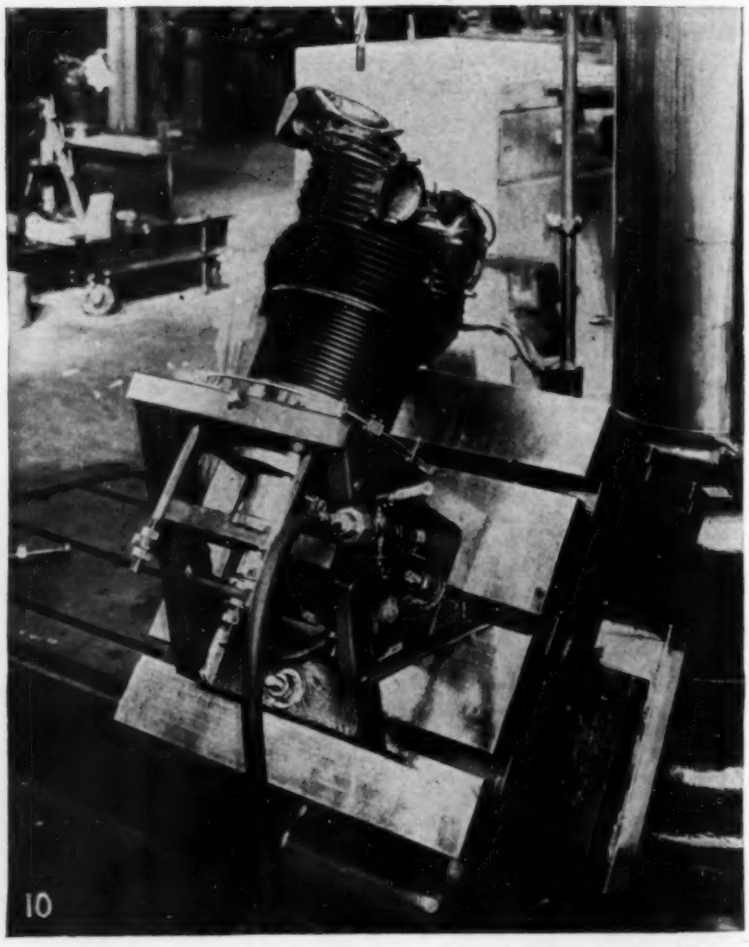


Fig. 9

Keeping Navy Aircraft Engines in Trim



[10] A quick-operating air clamp is the principal element of this reaming fixture for valve guides. The angle plate is bored to receive the cylinder, which is positioned by a dowel to bring the valve guide under the drill. Four clamping rods 90 deg. apart carry swinging tops that lock over the cylinder flange. The ring connecting the clamp tops insures their simultaneous operation. Clamp rods and tops are interchangeable for various sizes of cylinder heads

Rust Preventers and Slushing Materials

E. E. HALLS

What materials are available for "temporary" rust prevention? What are their characteristics and comparative advantages? Here are answers to these and related questions

ALL PRODUCTION men have been faced with the problem of reconditioning work that has been allowed to rust during passage through the shops or in storage, or even subsequent to shipment. Consequently, they are aware of the extra costs arising from interruptions of the factory program, apart from the actual cost of rectification or replacement of corroded members. Appreciation of the relative merits of various types of rust preventers in specific applications would do much to maintain this expense and inconvenience at a minimum.

Probably the outstanding feature of this century in metallurgy is the advance in non-corrodible metals and alloys. However, the highly resistant products have often to give place to ordinary materials because of cost. This condition will probably exist always, and the job of combating rust formation on ferrous alloys will always be important.

The development in metal protection has proceeded along several distinct lines, each covering types of processes with definite functions. Metal coatings, paint, varnish and enamel coverings and oxide films may be cited as processes that have achieved technical success. On the other hand, many assembled units have some members to which none of these processes can be applied because of fineness of tolerances, frictional surfaces or knife edges. Again, tools and machinery during shutdowns, components at intermediate stages of manufacture, and many bright-finished appliances and tools pending distribution to the final purchaser need attention for a particular type of protection. It is the rust preventer for this field of application that will be discussed in this article, and the media concerned will be designated as "temporary" rust preventers since their inhibitive properties are of relatively short duration. The requirements of these coatings, however, are often as stringent as those for the more permanent protective finishes.

Points which must receive consideration in selecting a temporary rust-preventer are: (1) conditions of storage, service and exposure; (2) contamination of other surfaces from handling contact or flowing off: (3) effect at bi-metallic junctions; and (4) time period. All of these points are of importance, and the neglect of just one may lead to trouble. Thus, an investigation into the following properties of the preventer is imperative:

Properties

1. Adherence and tenacity. Between film and base metal, intimate contact must exist to permit mechanical movement from stresses in the part, and to resist weathering conditions without lifting or rupture. The film must form a continuous permanent coating to protect the work.

2. Continuity and non-porosity. Independent of quality of surface finish and irregularity of profile, the medium must provide a continuous film without break at sharp edges or at rough spots associated with machining. Also, there should be no porosity such as that resulting from the crystallization of certain varnishes.

3. Chemical characteristics. Stability of the medium without separation or decomposition during storage, as well as in the film form under service conditions, is necessary. Likewise, non-volatility of the film after evaporation of the solvent is essential. Again, inertness is essential to avoid chemical action upon the metal to which applied or upon adjacent metals with which it may come in contact.

4. Ease of application and removal. The medium must be capable of efficient application by means of ordinary workshop methods of spray brush or dip. In the same manner, its removal must be readily and economically effected by solvent or mechanical means.

5. Type of film. Media giving the following types of film are available: (a) Hard, dry, varnish films; (b) Non-drying, gummy films; (c) Soft, non-drying oil or grease films; (d) Loosely adherent basic films.

6. Regularity and cost of supply. From the nature of the application the same economic control with respect to quantity per square foot as is the case with electrodeposits cannot be attained, and therefore, prime cost is

Atmospheric Exposure Test Results—Iron and Steel

Type of Medium (dipped)	DURATION			
	1 Day	7 Days	21 Days	28 Days
Paraffin	Oil run off. Patches of rust appearing..	Plates dry and heavily rusted	Discontinued	
Cellulose Lacquer	No effect	Lacquer film discolored	Rusting at edges	Rusting spreading. Lacquer film lifting
Spirit Varnish	No effect	Thin film of rust on all samples	Rusting increased	Discontinued
Oil Drying Varnish	No effect	Rusting at edges	Edges heavily rusted and some rusting on surfaces	Discontinued
Non-Drying Oil Varnish	Unaffected	Unaffected	Unaffected	Rusting near edges
Light Mineral Oil	Small areas rusted	Oil drained off. All samples rusted	Discontinued	
Medium Mineral Oil	Unaffected	Small areas of rust on all samples	General rust over all surfaces	Rusting generally bad
Heavy Mineral Oil	Unaffected	Unaffected	Traces of rust on many samples	A few samples unattacked. No marked change.
Thin Mineral Jelly	Unaffected	Unaffected	Rusting on edges	Slight rusting over surfaces
Thick Mineral Jelly	Unaffected	Unaffected	Unaffected	Rusting on edges
Lanolin	Unaffected	Unaffected	Unaffected	Very slight rusting on edges
Lanolin Mixture 1	Unaffected	Unaffected	Unaffected	Unaffected
Lanolin Mixture 2	Unaffected	Unaffected	Unaffected	Unaffected.
Soluble Oil	Unaffected	Surfaces tarnished, patches of rust appearing	Rusting general	Discontinued

very significant. Regularity of supply of the same grade of material is essential.

However, even if the best choice of rust preventer is made, the coating will prove of little value unless thorough cleansing of the metal surface is first effected. Machined work subject to the usual few days' delay in passage to the finishing shop is slushed with mineral oil without any treatment to remove cutting fluids, but this is a case where the object is to avoid general rusting and where the expense of a cleaning operation before slushing to insure complete protection is not warranted.

The cleaning operations entailed are simple ones with which most industries are familiar. They can be classified under two **main headings:**

1. Removal of dirt and grease by means of:
   a. Solvent vapor, as in a trichlorethylene degreaser.
   b. Liquid solvent. A coal tar product is usually preferred, being less irritant to the operator than petroleum products.
   c. Caustic detergents. Hot 5 to 10 per cent caustic soda solution is most widely utilized, but in specific instances water glass solutions or lime suspensions are employed.
2. Removal of oxide, scale and rust.
   a. Mechanically, by scratch brush or sandblast.
   b. Chemically by an acid pickle to suit the particular metal in question. Hot 7 per cent sulphuric acid, or cold 50 per cent hydrochloric acid, both with inhibitor, are most useful.

Application of the rust preventer should be carried out immediately after cleansing in a manner that will insure a complete flowing of the preventer over the surfaces to be coated, either by dipping, brushing, or spraying after dilution with a solvent. The application of greases by smearing with cloths must be avoided. With the exception of lanolin application, smear marks are always evidence of non-continuity, and rusting proceeds along them.

Rust preventers of the hard dry varnish type can be prepared in the works, but generally it is preferable to rely on proprietary varnishes supplied by reputable firms. Products of widely differing nature are obtainable, but the more usual fall within the following groups: (1) Cellulose media; (2) Gum-spirit varnishes; (3) Gum-oil varnishes.

These varnishes are all fluid, quick-drying products and are easily applied. The cellulose media are not to be confused with the ordinary cellulose lacquers, but are specially designed for adherence and non-porosity by judicious balancing of gum, plasticiser, and cellulose product. Their evaluation can only be derived with satisfaction from durability tests. The second group comprise the solutions of resin, of which rosin is a common ingredient. They are not satisfactory as a whole, owing to cracking and powdering of the film. The third group is the most satisfactory, comprising oil varnishes of high gum content. The drying oil constituent of these varnishes, linseed or tung oils, increases adherence, continuity at sharp edges, and resistance to aging, and decreases tendencies to crack. In certain applications, linseed oil itself offers possibilities, applied with or without dilution and preferably boiled.

Where Appearance is Important

Where grease contamination cannot be tolerated, or appearance is of prime importance, as in instrument work, there is no alternative to these dry film bodies. Their shortcomings, however, must be recognized, including tendency to acidity which tarnishes bright steel, cracking, flaking or powdering, brittleness, and shrinkage from the sharp edges during drying.

In order to overcome the aging propensities of the dry oil varnish films, and at the same time to retain the adherence which is their main feature, some manufacturers market non-drying varnishes which consist of oil varnishes containing a proportion of viscous mineral oil. The high viscosity of such products aids the adherence,

and the resinous constituents add to the impermeability, thus affording good protection to steel. But these factors are offset by the corrosion on non-ferrous metals if contact with the latter is likely. Furthermore, in common with the hard varnish group, solvents or prolonged soaking are necessary to remove the gum-like films.

Mineral Greases for Effective Coatings

Non-drying oils and grease films, largely of the petroleum oil and jelly groups, now constitute the major portion of the media used for rust prevention. Mineral lubricating oils offer a wide range of products at low cost, differing essentially only in viscosity, and give satisfaction providing their limitations are recognized. By correct selection relative to viscosity range rust preventers can be selected from this group to give continuous, adherent films that are stable and inert. Application and removal are exceedingly simple, the former being facilitated by heating the oil. The outstanding defects are rupture of the film at sharp edges, where rusting invariably first occurs, and rusting under the film due to failure to remove all water or moisture from the parts before application.

For mineral jellies, the same advantages and disadvantages may be claimed as for mineral oils, but being semi-solid they possess the additional quality of "staying-put." They are procurable in a wide range of melting points and a variety of shades from white to brown.

Lanolin As a Rust Preventer

Lanolin is a fatty grease obtained from the wool-washing industry. Several grades are available, and it is soluble in the chief organic solvents. Its excellent rust-protecting qualities seem to depend upon its ability to absorb small quantities of moisture, and it is, therefore, important to employ grades of low water content. It is well known that where lubrication has to be effected on frictional elements in contact with water, as in the case of pumps, a tenacious lubricating film is produced by incorporating a small amount of a fatty oil. It is in a like manner that parts exposed to moisture-laden atmospheres will, if coated with lanolin, be prevented from rusting by the permanent emulsion forming. Absolute dryness of surfaces to be treated is thus also not so essential as is the case when non-emulsifying rust preventers are used. Its one disadvantage is, that being composed of fatty esters it is naturally acid, and in stored conditions this acidity may increase. The acidity of a goor grade lanolin, however, is low and will be without action on steel. Because of the corrosive action on non-ferrous metals it is necessary in its application to insure that in assembled units it is not brought into contact with the common cooper nickel alloys.

The grease film obtained from lanolin application is strongly adherent, tenacious, non-porous and under normal service conditions non-volatile. Applications and removal are simple to effect. Solid application by smearing with a soft cloth may be employed, but in general practice this method does not give complete covering. A 50-50 solution in petroleum spirit is best.

Lanolin rust preventers are marketed as proprietary products, and may include additions of wax for hardening, or dyestuffs to render the efficiency of coating operations obvious. That the wax does not separate in storage must be ascertained. These mixtures may also include lanolin in light mineral oil. Unless suitable facilities exist for controlling the operation of preparing these mixtures, the purchasing of a reputable mixed product is recommended.

Alkaline Coatings Not Reliable

Soda solutions are in general use in machine shops for the operations of drilling, milling, grinding and turning. After machining it is customary to allow the solution to dry off on the work. During the short interval between the machining operations and finishing or assembly, very little rusting occurs, except perhaps at sharp edges, but rust protection from soda solutions can be relied upon for only a few days even under dry conditions.

A similar form of protection is afforded to iron and steel parts when degreased in caustic-soda, soda-silicate, and similar alkaline solutions. The protection afforded by basic films is probably due to their neutralizing the corrosive atmospheric agents and consequently is of limited duration. Handling of parts so coated is undesirable from the health point of view. Cleansing is somewhat difficult, alkali adhering tenaciously, and other disadvantages of this class of preventer restrict them to a very limited field.

A careful survey of the problem must reveal that systematic methods to obviate rusting involve an expenditure that is very small compared with that of correcting damage. In conclusion, therefore, it is asserted that the judicious selection and use of temporary rust preventers must result in economies in production, smoother flow of work through assembly shops, and in some cases a more salable product. Finally, it is well to reiterate that technique is involved—clean surfaces, appreciation of all the factors pertaining to each job, plus proper selection and application.

Results of Humidifying Samples —Copper and Brass

Type of Medium (dipped)	Duration of Test in Days to Produce Corrosion
Cellulose Lacquer	No corrosion evident after 100 days
Spirit Varnish	No corrosion evident after 100 days
Oil Drying Varnish	No corrosion evident after 100 days
Non-Drying Varnish	Dark green corrosion compounds produced after 1 day
Paraffin	No attack at end of 100 days
Light Mineral Oil	
Medium Mineral Oil	
Heavy Mineral Oil	
Thin Mineral Oil	
Thick Mineral Jelly	
Lanolin	Film discolored to a green tint at end of 60 days
Lanolin, Mixture 1	Corrosion evident after 18 days
Lanolin, Mixture 2	Slight attack after 93 days
Soluble Oil	After three days heavy production of green compound

•

Cellophane-Windowed Gage Packages

TO protect its dial indicators in transit and storage, a New England manufacturer is now using a special form-fitting cardboard box covered and sealed with Cellophane. The dial face is visible and is covered by another cardboard cover. This type of packaging should insure that the gage is not handled between final inspection and use, and moreover should build esteem for the product and the manufacturer.

Intensive methods, rhythm and military discipline turn out specialists in tool and die making in record time. Whether the same methods could be used in America or not, the Soviets have developed a system that seems to work excellently for them

WALTER WELLS
Die and Jig Designer, Metropolitan Engineering Co.

All pictures by Soyuzphoto

Mass production in Russia means production by the masses

Soviet Russia Trains Her Future Mechanics

GIVEN a situation where there is an urgent demand for thousands of qualified tool and die makers, and where this demand cannot be met except by employing unusual methods for training such mechanics in the shortest possible time, the solution could not well be much different from the "regimented" training courses that are being tried out in Soviet Russia today. In accordance with this system, numerous groups of about 50 individuals are put through an intensive training course covering a 10-month period. Six hours each working day these groups apply themselves to the first steps in the theory and practice of toolmaking. No time is wasted. Their sole consideration is to reach the given objective in the most direct manner possible.

No doubt, some old timers may question the worth of these short courses of training, having gone through the customary four- or five-year apprenticeships themselves. But when all facts are considered, and we deduct from the four-year term time taken out for sweeping floors, oiling machinery, running errands and running production machines, how much time did we devote to actual training along toolmaking lines? From personal experience I would say that our training hinged entirely too much on the whims of the foreman or the chance vacancy of a machine. Yet, whether the directness of the new Russian system is an advantage in the long run is another matter again.

The heads of the machine and tool-building industry in Russia tackle the problem of training men from both ends, so to speak. That is, they not only intensify and "regiment" the training for the work, but they boldly divide up the trade of tool and die making into narrow specialties so that the "broadness of experience" with which we are acquainted is rendered unnecessary. It follows, therefore, that the apprentices achieve their goal much more easily. For instance, the youngster who is to become a toolmaker at the bench is trained with that end in view. It is not likely that he will be called upon to operate any of the machines outside of the drill press or die filer. Others are pointed toward the lathe or the miller. Die makers are grouped apart from the jig makers, with the gage makers in still another department. The big difference between this and the specialization that we have lies in that they purposely make the specializations permanent.

The candidates for a scholarship in a course of toolmaking are selected from the regular grade schools in various parts of the country in accordance with a quota. They are obliged to pass an examination in arithmetic and elementary physics in order to become eligible. The scholarship provides a monthly income sufficient to cover necessities—tools, material, books and housing being provided without cost to the student. Odd as it may seem to an American to speak of scholarships in connection with our trade, the Soviets have elevated every phase of machine making to the very highest plane. Hod-carriers are not considered more important than die makers over there.

If we picture a class of half a hundred young men and girls stationed behind as many work benches, doing setting-up exercises to the count of one-two-three-four, we get an idea of how a training group is initiated into

the mysteries of the trade. The purpose of this procedure is not merely to limber up for the day's work, but rather to develop a certain rhythm of motion, or tempo, as they call it It does not follow that automatons are developed by this method. That they are not becomes apparent when hammers and chisels are caught up and wielded against a block of iron. An efficient natural stroke is insisted upon by the instructor. No "choking" is tolerated. All hammers eventually click as one, to the count of one–two, one–two. Faults are detected instantly and corrected. It is likely that they got the idea from seeing a rehearsal of a group of violin players.

In time, the attention of the class is diverted from the stroke itself to the nature of the cut that is being made by the chisel. Groups are taken over to the grinding wheel and taught how to sharpen the chisel correctly. The stroking then develops into chipping. The cast-iron blocks are cleaned up on all six sides. Frequent intermissions are employed by the instructor to explain about obtaining flat surfaces, paralleling and squaring.

The second trip around the six sides, again with the chisel, is used to eradicate all "digs" and to prepare the block for finishing with the file and scraper. Before the hammers are laid aside, however, the toolmakers-to-be are given a final once-over to bring to light any who may be attempting to "choke" the handle.

The "how-to-file-flat" business is given a great deal of attention. The rhythmic stroke is thought into play again, but, of course, with slower counts. All the known tricks of filing are tried out. The block is finally smoothed up, made parallel and square all around, then inspected. If satisfactory, scraping-in begins. The theory of the work is explained while the surface plates are being made ready. Days pass by, even weeks, before the blocks are perfected. The first step in training gives way to the second.

The apprentices next try their hands in making various useful shop tools, such as hammer heads, parallel clamps, tool holders, boring bars, joint calipers, and tap wrenches. In an orderly manner they are shown how to drill, tap, file out holes, broach, saw, work to scale measurement and do things generally with high-grade workmanship. The product they turn out does not yet pay the cost.

Beginning with the second half of the course the class takes up the making of precision tools. Straight-edges, die-makers' squares, beam squares and combination bevels are shaped up, hardened and tempered, and finally lapped to approved standards. In this kind of work there is no attempt made to hold every student to the same pace. But great care is taken to see that the lapping is done in an intelligent manner. Meanwhile the apprentice makes acquaintance with the micrometer, the indicator, the verniers, the protractor and the height gage. Blueprints are introduced, pored over and made use of in the work. When the term is over, the precision tools that pass inspection are allotted to the tool-kits of those who made them.

With the beginning of the second year the "graduating" students are attached to the various toolmaking branches in accordance with a previous understanding. There are three factors that cooperate to select the individual for the particular work; first, the choice of the individual himself, second, the nature of the vacancies to be filled, and last, the findings of a special scientific "Trades Adaptability Institute." As an illustration of the second factor, if 50 per cent of the students choose to be bench workers at a time when there is a 75 per cent demand for machine-operating toolmakers the necessary adjustment must be made. As regards the third factor, this unique institute attempts, in a very mild and experimental form, to adapt the man to his job instead of allowing things to drift in the old hit-or-miss way. Incidentally, this institute carries on its experiments among all the trades and industries. Its main office is in Moscow.

The apprentice now becomes an actual worker and is put into a position where his product will more than cover the overhead costs. He has the opportunity to advance himself through what are called "categories," from the first to the seventh, the latter being the full-fledged mechanic, able to handle his work without aid. Whether placed at a machine or at the bench, the beginner is grouped with those of higher categories and a gang leader or senior. The training, though no longer planned in advance, still goes on rapidly, because it is the duty of the senior to supply each individual with work of increasing difficulty and variation. At the end of three years of training, in the manner above recorded, young Russians turn out complete follow dies and moderately complicated drill jigs. Several of the dies I observed were for blanks shaped something like the letter "s."

The toolmakers who operate the machines get to do some really nice work, tool. The lathe work, milling and grinding of those who were broken in during a parallel period with the bench men mentioned above, was fully up to par. My general impression gained by observing this development was that there is present a certain keenness which augurs well. What the future brings forth remains to be seen.

Youths of the middle Volga section learning to use hammer, chisel and hacksaw. The wall posters set forth the objectives and advantages of trade schools

Bell Laboratory plating room, showing four of the major plating tank units. In the foreground unit is a battery of small tanks used for gold, silver, copper and other somewhat special work. The other three tanks in order are for nickel, copper and zinc

Plating in a Laboratory Shop

In this important branch of the Bell Laboratories activities, dependable results are assured by rational methods and layout

HERBERT CHASE
Consulting Engineer

FEW plating departments cope with the variety or quality of work demanded in the plating room of the Bell Telephone Laboratories in New York. The variety runs the gamut of gold, silver, tin, cadmium, nickel, copper, brass and zinc, about 20,000 parts being plated each week. Efforts are made continually to handle this work on such a basis that a profit would result were the work done by an independent high-class commercial plater. Besides its production work, the department also develops plating methods in cooperation with the Chemical Research Department for use in the various manufacturing plants of the Bell System.

The accompanying plan shows the layout of the plating room. Adjacent to it are smaller rooms where microscopic and other inspection, as well as polishing, are carried out. The floor and lower walls of the plating room are covered with acid-resistant tile. Careful provision has been made for ventilation. Ducts made from Allegheny metal have openings adjacent to every plating and cleaning tank.

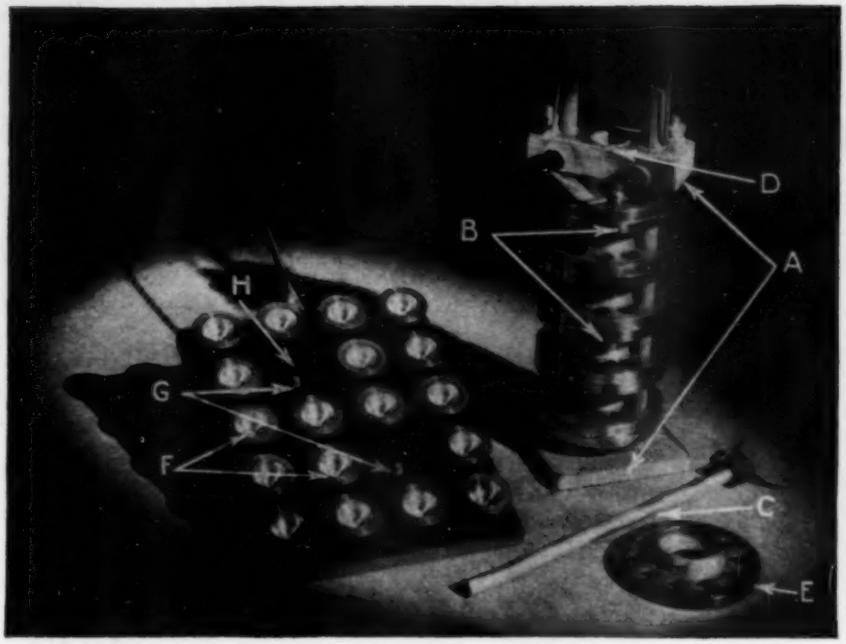
Cleaning tanks occupy almost all of one side of the plating room, there being three groups of cleaning baths, one hot and two cold. The first group of four tanks is for *A* (see diagram) hot water, *B* soap solution, *C* water wash, and *D* alkaline electrolytic cleaner. In the second group, tank *E* contains an acid bright dip, *F* and *G* hydrochloric acid pickles for steels and brasses respectively, and *H* clean water. *I* contains a cyanide dip and *J* clean running water. There is also a drying oven and a bin for drying in hot sawdust.

Plating tanks include: large cold and small hot tanks for zinc; large hot tanks for copper and nickel, and a group of small tanks for gold and copper (hot) and for silver, brass and nickel (cold). All tanks, except the two which are in one corner of the room adjacent to the cleaning tanks, occupy one side of the room and are supplied with current from a motor-generator rated at 500 amp., 6 or 12 volts. A 2,000-amp. generator serves the other two tanks.

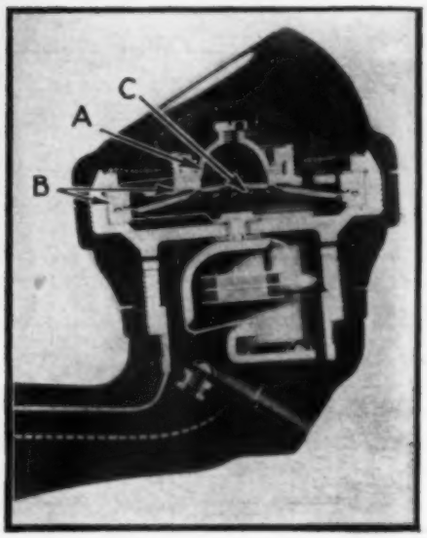
Most of the tanks have double walls with the space between filled with water and arranged for heating by steam. Thermostatic valves are provided. Each tank also has its own control board. In some cases, provision is made for operating two circuits simultaneously in the same tank. In the case of the gold tank, the warming bath is heated electrically and the small stirring devices are motor-driven.

For all jobs, except those of a purely experimental nature, specifications covering the entire plating process are followed carefully. Special care is used to keep the cleaning and plating solutions in proper condition. Exacting control is rigidly followed in every step so that

*Based on an interview with W. G. Knox, superintendent of the Finishing Shops of the Bell Laboratories. Mr. Knox, entered the Chemical Control Laboratory of the Western Electric Co. 28 years ago. He specialized in work on finishing materials and their application, and for many years was in the Research Department of the Bell Laboratories. When in 1928 the finishing shop was enlarged to handle experimental work on a greater scale, Mr. Knox was placed in charge of this important activity.



Special racks designed for holding parts to be gold plated. *A* — Rack for holding bridges, the holes in which are to be gold plated. *B* — Bridges mounted in place. *C* — 24-karat gold bar anode, which is passed through the holes. *D* — Guide for gold anode. *E* — Lacquered insulating rim on bridge. *F* — Domes mounted for gold plating. *G* — Mounting pins for domes on Bakelite panel *H*



Gold plated parts mounted in handset transmitter. *A* is the dome, *B* the bridge, and *C* the featherweight insulated diaphragm

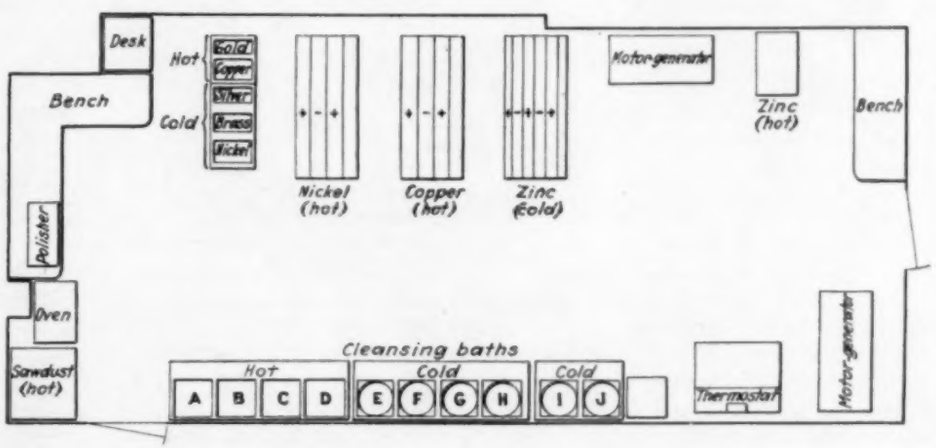
the required uniformity of results can be secured. Certain examples will illustrate the pains that are taken.

Among the parts to be gold-plated are those in contact with carbon granules in the handset transmitter. The gold deposit prevents pitting of the metal, which is likely to occur with other coatings. It is of extreme importance that even the finest particles of foreign matter be kept from the gold-plated surfaces of these parts, for otherwise a frying noise results that is unpleasant and disturbing to clear conversation. For this reason, extraordinary precautions are taken in cleaning the parts both before and after plating. When finished, certain parts are given 100 per cent inspection under a microscope to make sure that no foreign matter remains.

Before plating the brass parts in question, they are first semi-polished and then dipped in a mild alkali electrolytic cleaner, and almost immediately thereafter are rinsed, first in hot water and then in cold running water. Next, the parts are given an acid dip and then are washed in water and dipped in a cyanide solution to remove any stains. They are again rinsed and immediately placed in the plating bath for 25 min.

In the case of one part having a cylindrical hole which is to receive the plating, a gold rod serving as the anode is passed through several pieces which are racked for this purpose. Other dome-shaped parts are fitted into a plate of non-conducting material machined with recesses. Specifications in the case of these parts call for deposition of a minimum of 30 mm. of gold per sq.in., but it is customary to apply 50 per cent more for safety. The even distribution of the deposit maintains mechanical tolerances.

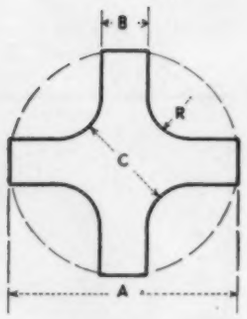
After gold plating, the parts are rinsed in water, from which the gold is later recovered. They are again rinsed in cold water and next in clean boiling water for 5 min., after which they are dried in an oven. Parts known as bridges are lacquered on portions of the surface not gold-plated to provide insulation. These parts are then washed in clean warm water, using a rotating brush on the gold-plated surface to insure removal of all adherent particles. They are again washed in clean distilled water, dried and inspected under the microscope.



Floor plan of the plating room, showing the arrangement of the plating tanks, chiefly on one side, and the cleaning tanks along the opposite wall

Tools of Reamer-Section Steel

HERBERT M. DARLING
Wells Manufacturing Company



Four Fluted Section H.S.S.

A	B	C	R	Wt per Ft Lbs.
11/16	5/32	11/32	1/8	0.8
13/16	11/64	3/8	1/8	1.0
15/16	3/16	27/64	9/64	1.4
1 1/16	7/32	15/32	9/64	1.8
1 3/16	1/4	17/32	5/32	2.6
1 5/16	9/32	19/32	5/32	3.1
1 7/16	5/16	21/32	3/16	3.6
1 9/16	11/32	23/32	3/16	4.1
1 11/16	11/32	3/4	5/16	4.3
1 13/16	11/32	3/4	5/16	4.6
2	11/32	3/4	5/16	5.2
2 5/16	13/32	1	1/2	7.4
2 9/16	13/32	1 1/8	3/4	8.5

Fig. 1—A reasonable range of standard reamer-fluted sections is now available

MANY MAKERS of tools have overlooked the possibilities of reamer-section high-speed steel. This material has been on the market for several years, but has been used only in a limited way for pipe taps and bridge reamers. While its cost per pound is about 10 cents higher than that of round stock of the same grade, less weight is required, and the fluting operations are eliminated. A cross-section of the steel and the range of sizes rolled by one of the leading steel makers are given in Fig. 1. Several steel mills are now producing this material in rather small quantities up to 2⅝ in., the range of sizes varying somewhat.

I have used this material for a variety of tools, as shown in Fig. 2. In making pipe taps, the threads are milled in the rough stock. Bridge and locomotive reamers, four-fluted drills, core reamers, and other tools are easily made from this material. Straight-fluted tools for brass and bronze are made directly from the annealed bar, while for helically-fluted tools it is necessary to twist the steel to the helix angle required. The blanks are punched for location of the centers by means of a bell center punch, heated to about 1,600 deg. F. and then twisted in the hand-operated bolt cutter shown in Fig. 3. To this machine has been added a tailstock having a lever-operated, square spindle and the drivers *A* and *B*, Fig. 4. The driver *A* is made in five sizes to suit the range of the fluted stock. The driver *B* is held in the live spindle when twisting tools that are to have the shanks left straight.

A double-deck high-speed furnace is used for heating the blanks for twisting. The blanks are preheated in the upper chamber and are then transferred to the lower chamber for the final heating. If the blanks are not heated above 1,600 deg. F., they will nearly always machine easily without being annealed. Occasionally the larger blanks will be heated much above this temperature for ease in twisting. Blanks so heated will have to be annealed. When putting through a small lot, the blanks can be heated in the lower chamber of the furnace, twisted, and then put in the upper chamber and left to

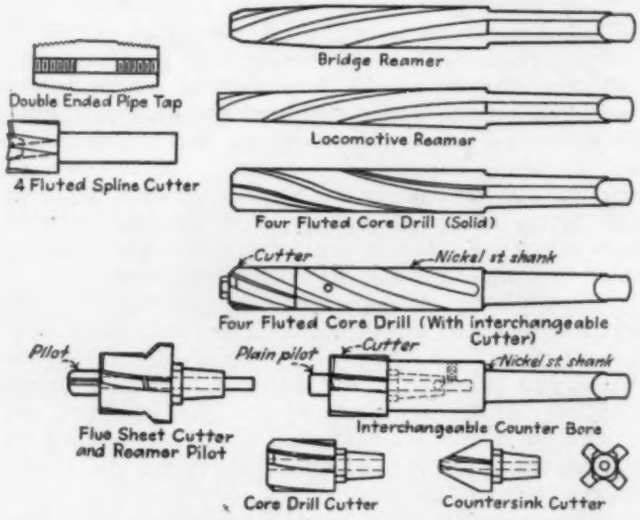


Fig. 2—Cutters of a wide variety are readily made from fluted stock. The time and material saved more than offsets the increased price per pound

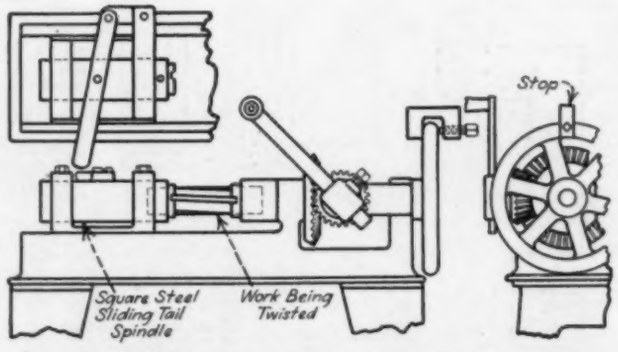


Fig. 3—Helical tools may also be made by hot twisting the stock in a standard bolt cutter adapted for this work

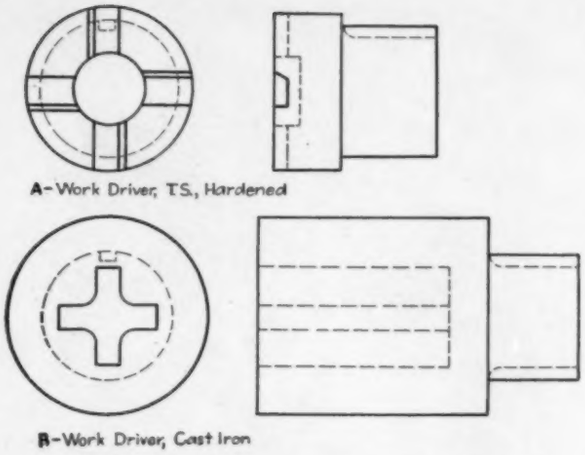


Fig. 4—These drivers are employed for tools with helical flutes. A deep socket as at B is used where the shank section is to be left straight

cool with the furnace. This will generally anneal them sufficiently for easy machining.

After machining, the tools are hardened in the usual manner, ground to size, and the flutes ground or sand-blasted. It will be found that these tools possess greater strength and resistance to twisting than tools having milled flutes.

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The Lycoming Protest—*Discussion*

H. D. MURPHY

IN VIEW OF your editorial request for similar protests (*AM*—Vol. 76, page 288f) from other plants perhaps you and your readers may be interested in a few reasons which occur to the writer for not signing such a protest. In the first place the budget for the year *ending* June 30, 1932, was made up quite some time ago. While conditions were not as bad as now they were bad enough to have warranted a protest. No protest was made—at least not a general one. That budget cannot be changed; we must take our medicine and meet it. In the second place the protest states that industry, facing a similar situation, applied a "solution" by a thorough slashing which of course included wages and salaries. Please explain just what was solved. With incomes steadily reduced can it be shown that business indices have advanced in the same period? In the third place the writer for one believes there are justifiable excuses or rather reasons for maintaining the scale of compensation of government employees. For lack of space this statement must remain just as unqualified as the opposite statement in the protest.

Taking up the three points of the petition, let us ask our representatives not to reduce the salary and wage scale but to amputate from the government payroll the thousands of employees who are not needed at all, regardless of their rate of compensation. This can be brought about by making effective the elimination of bureaus asked for in points two and three. In reference to point three, not only should economy be stressed but uselessness as well. Every bureau and position that is paternalistic or frankly "pork barrel" in type should be abolished. This is our opportunity to demand a correction of those evils which our previous complaisance has fostered.

The writer does not believe that the ability of a few concerns to operate profitably on fifty per cent or less of capacity will raise us from the valley of depression to the mean of normalcy. What is needed is to get that other fifty per cent back on the sales books and payrolls. Reducing prices has not done it. Reducing wages and salaries has not done it. Will reducing more incomes do it?

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Drill Holder for Deep Drilling *Discussion*

J. T. TOWLSON
London, England,

REFERRING to the comments by Henry W. Boehly (*AM*—Vol. 75, page 897) on the article by J. B. Walsh under the title given above (page 318), while the job referred to barely comes under the head of deep drilling, I think his design of a slipping device to prevent the drills from breaking gives ample evidence of an apprentice's ingenuity and is highly commended.

Such work as Mr. Boehly refers to is, of course, common in general machine shops, including the shop with which I have been closely associated for many years. For such work as the opening out of cored holes, any of the commercially procurable tapping attachments can be easily adapted. It is necessary only to machine a drill sleeve to fit the attachment to provide a thoroughly reliable drill-slipping device without militating in the slightest degree against the quality of the device as a tapping attachment.

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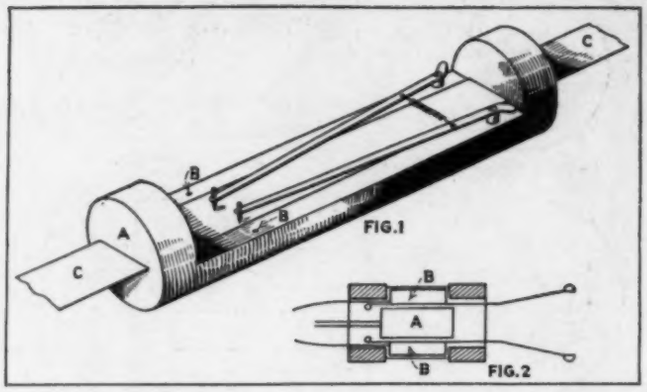
Jig for Drilling Packing Glands *Discussion*

T. GREENING
Coventry, England

REFERRING to the jig described by Charles C. Tomney in an article under the title given above (*AM*—Vol. 75, page 932), the use of a sliding V-block for positioning triangular flanges, while appearing to be foolproof, leads to trouble at times. If either the central hole or the boss, as the case may be, is not machined true to the outline of the casting, the use of a V-block brings one hole true to the center, but doubtless the error on the others and often spoils the appearance of the flange.

On oval flanges, we found that it paid to discard the V-block in favor of outlines for locating the work for drilling. In this method, the jig is made of the same shape as that of the work and the work is set by "feel." If a plate jig is used, a metal templet $\frac{1}{8}$ in. larger all around than the work may be employed. An alternative is to scribe the outline of the work deeply on the jig plate. In either case, the operator has to set the work by sight. While appearing to be slower in use, we found that it paid in the long run to use one of these methods, as we got less faulty work.

IDEAS FROM PRACTICAL MEN



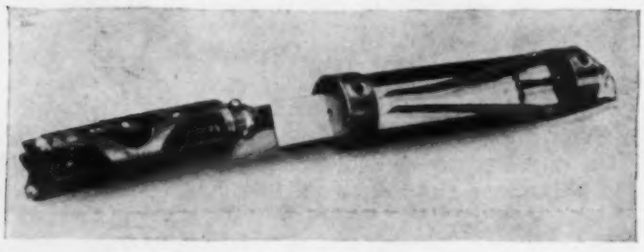
Measuring Long Bores by Tape and Transformers

FRANK C. HUDSON

A METHOD of measuring bore variations in a long oil-well pump cylinder is shown in Fig. 1. The body *A* is a round piece of steel with half of the round cut away in the center, leaving the two ends, which are a free fit in the pump barrel to be measured. The two pointers have hardened contact points at the short end and carry phonograph needles at the other. They are pivoted as shown and have a light spring near the pivots tending to draw the points together. When not in use the needles drop into the holes *B* to hold them against movement.

In use tape *C* is blackened, put through the slots in each head and the whole put into the pump barrel, the paper strip or tape being held against movement. The needles have been taken out of the holes and placed on the tape, the spring holding the contacts against the pump barrel. The measuring head is then pushed through the barrel by means of a light rod at the end. Each needle makes a mark on the blackened surface of the tape as it moves over it. If the bore is uniform the lines will be parallel but any variation in diameter will be indicated by the varying distance between the lines. With a 20-to-1 ratio between the long and short ends of the levers, any variation is multiplied 20 times and shows exactly at what part of the bore it occurs.

Another method of measuring variations in the interior diameter of a long pump barrel is based on the effect of varying the air gap in a transformer. The device is shown in Fig. 2. Inside a shell that is a free fit in the barrel is a small transformer with the primary coil in the center at *A*. Each side of this is a part of the secondary coil as at *B*. Leads from both coils run through an insulated cable to a sensitive millivoltmeter mounted on a suitable stand at the end of the measuring bench. Each of the secondary coils are carried by a light lever, pivoted as shown, and the outer ends of the levers carry a small measuring point of hard material. The current in the primary coil comes from a small bell transformer of low voltage while the secondary coils are wound to give a low voltage, which is indicated on the millivoltmeter. The device is so adjusted that there is a normal air gap between the primary and secondary coils when the pointers are in contact with a tube of normal diameter. Variations in the tube diameter change the air gap between the coils and the ensuing fluctuations in voltage are shown on a fairly wide division scale on the millivoltmeter. The device works well and has proved satisfactory. It is much easier to use than the one with the paper tape, the only advantage of the former being that it provides a record instead of depending on observation. These methods were devised and are used by the D & B division of the Emsco Company, Los Angeles.



Fixture for Coiling Pipe

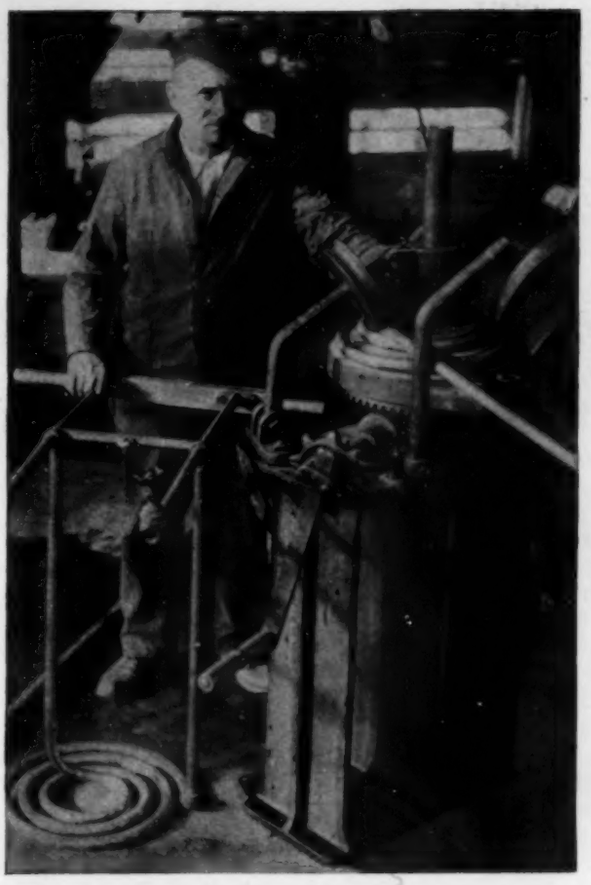
AVERY E. GRANVILLE

If called upon to make a pipe coil such as is shown in the lower left-hand corner of the illustration, many mechanics would be puzzled as to how to proceed. To make one or two such coils would be a fussy job at least, but to produce them in lots of from 25 to 100 on a commercially profitable basis would not be so easy.

One shop, making coils for heating water in small tanks, has solved the problem by making the simple bending fixture illustrated. The form over which the pipe is bent is made of cast iron and revolves on a vertical shaft. On its upper face is a groove that is a combination of a spiral and a helix. On the lower face is a bevel gear. Ordinarily, the form is revolved by hand by means of a crank and a pinion, but it may be driven by power by means of a chain-and-sprocket drive from some convenient power source. The driven sprocket for this purpose can be seen just back of the crank.

The pipe is held in contact with the revolving form by means of a roller that is grooved to suit the pipe being bent. The roller is free to revolve and to slide up or down on the pivoted, inclined shaft upon which it is mounted and is held in contact with the pipe by hand, forcing the pipe to conform to the "thread" of the form.

After the coil has been formed, the straight part of the pipe is bent upward against the roller. Various forms

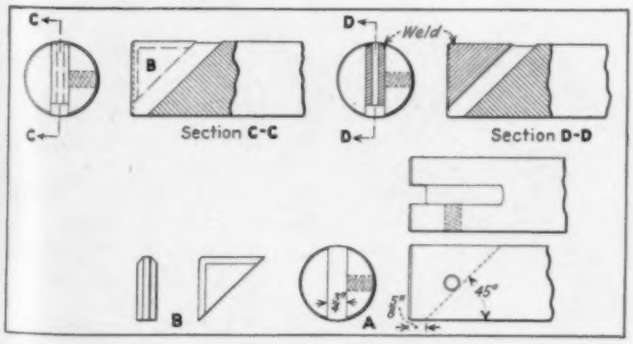


for different sizes of pipe may be used on the fixture. For bending pipe up to 1 or 1¼ in., no filling is necessary. One man can make a surprising number of coils per day with little exertion, since the leverage gained by the crank and pinion is sufficient to make the work easy.

An Inexpensive Boring Bar

CHARLES C. TOMNEY
Chief Tool Designer, Brunswick-Kroeschell Company

In the illustration is shown a boring bar that we use in boring blind holes, such as the cylinders of small steam engines, closed at one end. The bar is of cold-rolled steel, 3 in. in diameter, and the cutter is set at an angle of 45 deg., projecting slightly beyond the end of the bar. Since the holes in the stuffing-box ends of the cylinders are too small for a pilot, we use an unpiloted bar held in the turret toolpost. As the work is in small quantities, we did not feel warranted in making expensive tools for the job. While there is nothing new in a bar of this type, the method used in making the square hole for the cutter is rather out of the ordinary.



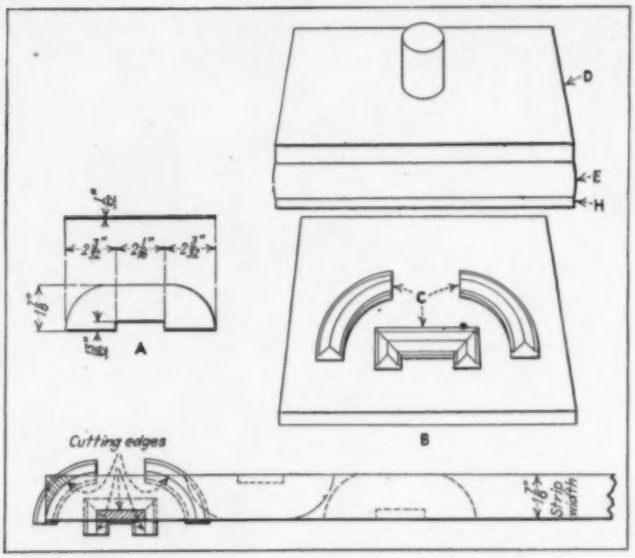
Instead of drilling a hole in the bar and filing it to fit the square cutter, as is the usual practice, we milled a slot in the end of the bar at an angle of 45 deg., as shown at *A*. Then we made the closing piece *B* and set it in place, as shown in the section *C-C*. This piece was then welded to the bar, as shown in the end view of the section *D-D*, leaving a square hole for the cutter. This method of construction makes an inexpensive tool.

Blanking Tools for Soft Material

BERTIL FALCK
Mechanical Engineer, Star Electric Motor Company

We needed pieces such as the one shown at *A*, in quantity and in six sizes. The material was $\frac{1}{32}$-in. oven-treated duck. At first, regular blanking tools were suggested, but one of our diemakers conceived the idea of the die *B*, which was made.

The pieces *C* are knives, hardened and ground and mounted on a soft steel plate. In making the two circular knives, they were screwed and doweled to a steel disk



attached to the faceplate of the lathe and turned. The same disk was used for grinding them. The straight knives (three pieces) were ground in the surface grinder. To get the cutting edges of the knives all the same height, after the edges were finished the backs were ground in the surface grinder.

Fitting into the ram is a pressure block. While the part *D* is an ordinary punch-holder, the 1-in. rubber pad *E* and the hardened and ground plate *H*, somewhat softer than the knives, were added. The material is in strips 1⅞ in. wide and its width in relation to the die is shown in the lower part of the illustration.

In cutting the blanks, the rubber pad is compressed and prevents the plate *H* from injuring the knives. By turning over the material after each cut, as indicated by the dotted lines, material is saved, as we get one more piece from each strip than we would if the material were kept the same side up far all the blanks. The advantages

of this construction are that the same pressure plate can be used for all the six dies, and the time of setting the tools in the press is considerably less than with blanking tools of the ordinary type.

By making the tools as described, instead of with cutting edges all around, we eliminated three straight knives and cut the material waste to the minimum. These tools have been in intermittent use for more than a year, giving good, clean cuts, and the knives have never required grinding. I believe that tools of this type could be used in cutting a variety of soft material, and even thin metal.

Relation of Die Clearance to Metal Thickness—*Discussion*

M. P. DALTON

In an article under the title given above (*AM*—Vol. 75, page 495), John J. McHenry, gives a rule for determining die clearance and touches upon the unequal clearance that results from improper die setting.

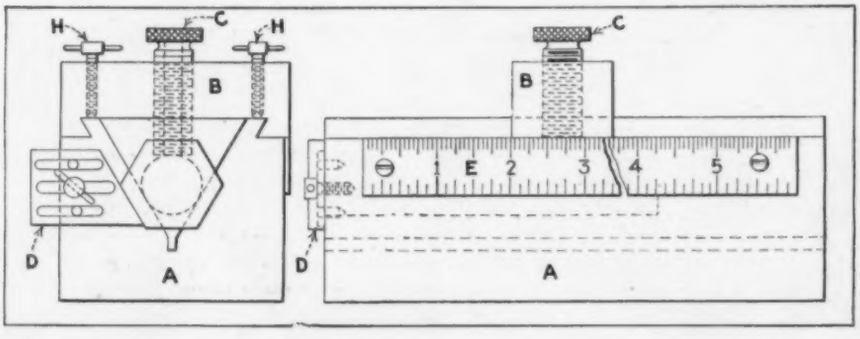
From experience in all ways of testing die setting, I think that shearing a piece of paper in the tools after setting them in the press is the best method. The thickness of the paper should suit the clearance of the dies, but need not be exact. If the die is too close to the punch at any point, the paper is cut. If the tools are properly set, the punch will emboss its outline evenly.

A Universal Jig for Pin Holes

CHARLES KUGLER

The writer designed and made the jig illustrated for drilling pin holes in bolts and rods for general use in a large plant. The jig consists of the long V-block *A;* the sliding head *B,* dovetailed to fit the V-block; the threaded bushing *C;* the gage *D;* the scale *E;* and the two thumbscrews *H*. The work is automatically centered in the V-block and is held in place by the threaded bushing.

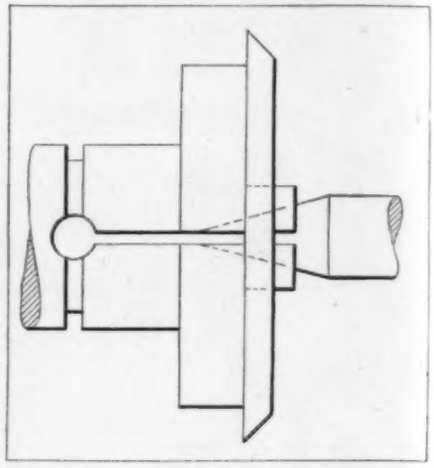
For hexagon-head bolts, where the pin hole must be in a certain position in relation to one of the sides of the hexagon, the gage *D* is used as shown. It slides on two pins and is held in place by a thumbscrew. For plain rods, the gage is moved inward and acts as a stop. The sliding head can be so set as to bring the bushing to a definite distance from the end of the work, by means of the scale. Where two or more holes are to be drilled in one piece, and at definite center distances, other sliding heads having the necessary bushings can be used.



Tools for Chamfering Washers *Discussion*

HARRY SHAW
Consulting Engineer, Heywood, England

In discussing the article by Charles Kugler under the title given above (*AM*—Vol. 75, page 213), Arthur Silvester (page 859) advocates chamfering the washers in the lathe, holding them on a split arbor expanded by screwing in a taper plug, or by holding them by a wedge. More time will be taken in screwing in the plug or inserting the wedge than in doing all the other work.



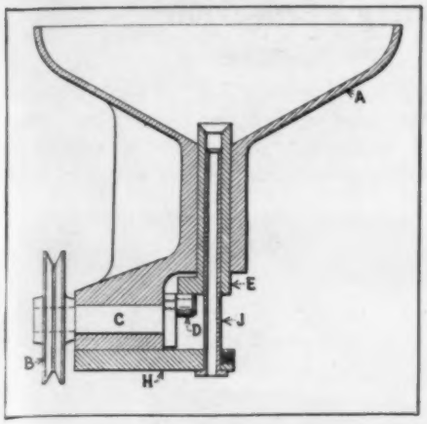
On similar work, I have employed a device similar to that shown in the accompanying illustration. The arbor is expanded by jamming in a taper piece attached to a ball-bearing center held in the tailstock. The action is quick, and the withdrawal is equally quick. I would consider the hole at the bottom of the slots in Mr. Silvester's device to be too small, making the arbor too stiff to expand easily. A groove around the arbor, as in my illustration, considerably eases expansion.

A Simple But Efficient Hopper for Feeding Cylindrical Parts

JAMES R. CORNELIUS
Machine Designer, Coventry, England

In the accompanying sketch is illustrated an efficient though simple hopper for the automatic feeding of cylindrical parts, the length of which exceeds the diameter by at least one third, but not by more than 500 per cent. Since the parts fed are not forcibly discharged, but must flow through the feed tube to the tool by gravity alone, it is necessary to place the hopper as high above the tool as is permissible for easy feeding.

In operation, the parts are thrown into the container *A,* which is of inverted pyramid section, permitting them to congregate in a mass about the apex. The grooved pulley *B* is driven by belt from a convenient source of power, causing the shaft *C* and also the crankpin *D* to rotate. The crankpin, which is fitted with a roller, or better still a small ball bearing, causes the agitator *E* to oscillate up and down in the container extension. A spring, not shown, is attached to the agitator to retain close contact between its



heel and the roller. The retaining strap *H* is fitted to the under face of the hopper base and locates the feed tube *J*, which is a sliding fit in the agitator.

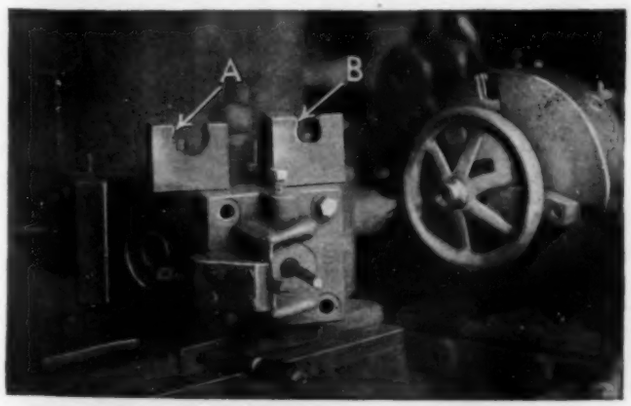
The top of the feed tube can be regulated for height by means of a setscrew in the retaining strap, its general height being such that when the agitator is in its lowest position, the top projects slightly above the lowest edge of the cone of the agitator. Both the tube and the agitator are countersunk at an angle suitable for the diameter and length of the work for which the hopper is intended. A variation in this angle sometimes increases the efficiency of the hopper to a surprising degree. For general purposes, an angle of 50 deg. will be found suitable.

The speed of the hopper shaft may vary between 400 and 80 r.p.m., the faster speed being for work about $\frac{1}{8}$ in. in diameter and $\frac{3}{8}$ in. long, which with an agitator stroke of $\frac{1}{2}$ in. will give a feed of approximately from 400 to 450 pieces per min. The slower speed, with an agitator stroke of about $1\frac{1}{2}$ in. will give an approximate feed of from 75 to 80 pieces per min. for work $\frac{1}{4}$ in. in diameter and $2\frac{1}{2}$ in. long.

Tools for Turning Handwheels

ARTHUR DOUGLAS

Recently, I have noticed in various mechanical journals descriptions of a number of devices for machining the rims of handwheels, many of which employ single pointed tools mechanically guided. While these devices are all right in their places, they are generally too complicated and too slow for manufacturing. A faster method is to use roughing and finishing tools such as are shown at *A* and *B* in the illustration. These tools are used by one of the largest handwheel manufacturers in the country. The tools are held in the cross-slide turret of a turret lathe. The roughing tool has serrated edges to break up the scale, while the edges of the finishing tool are smooth.



The recesses of the tools are considerably larger than the handwheel rims, the gaps being wide enough to clear the sides. In use, the roughing tool is fed straight in, turning the periphery first, then it is moved first to one side and then to the other to rough off the sides. The finishing tool is then brought into position and is used in the same way, making a nicely rounded rim in very quick time.

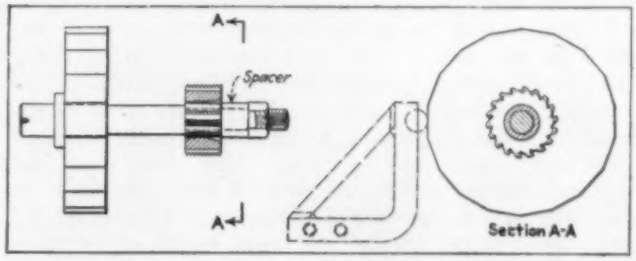
Where but a few handwheels are to be turned, a single one of these tools can be used in an ordinary engine lathe, as it will stand up for both roughing and finishing if too much is not required of it.

A Simple Backing-Off Attachment

HAROLD F. KARRENBAUER

Since our shop is of the maintenance type, we had no lathe equipped with a backing-off attachment, and of necessity had been buying all of our form cutters. Recently, we required a quantity of form cutters, which we made ourselves, doing the backing off by the simple device illustrated.

The cross-feed was disengaged, and a suitable counterweight was attached by a cord to the toolblock, running over a sheave at the back of the lathe. A backing-off



cam having as many flats as there were teeth in the cutter, was mounted on the same mandrel as the cutter. The stop for the backward motion of the toolblock was a steel ball let into an angle plate mounted at the rear end of the carriage. As the cam revolved, its angular faces imparted a slight oscillatory movement to the toolblock and the tool, thus giving clearance or relief to the cutter teeth. The depth of cut was controlled by the compound rest. By means of this simple device, we obtained excellent results.

Holding Thin Work in the Lathe Chuck
Discussion

DONALD RAEBURN
Glasgow, Scotland

In an article under the title given above (*AM*—Vol. 75, page 390) Richard H. Kiddle comments on the criticisms of Charles Kugler and myself (Vol. 74, pages 915 and 876, respectively) on his method of holding thin work. He states that he has used his method for some time without any mishap. That I can understand, as I have also used the same plan, but discarded it for one that I consider better and safer.

The use of the dial gage is common among machinists today, and any suggestion as to the use of ground pack-

ing blocks or parallel strips being a waste of time, may be dismissed. Good machine equipment and methods are never a waste of time; they are time savers. I have used ground packing blocks in the lathe, milling machine, vertical boring and turning mill, and with the chuck or table in good condition, the setting of the work was simplified and the operator could proceed with confidence. Where advisable, he could use the ground blocks as a datum face for gaging.

With reference to the type of chuck used, some chucks are independent, while others are a combination of independent and universal. Some of these chucks have jaws with a tapped hole on the face of each step. The jaws are also hardened. Other chucks have unhardened jaws of tough material, but they can be drilled and tapped if necessary. These unhardened jaws are the usual type provided by the machine-tool builder.

Relative to the question of tightening the chuck jaws while applying the dial gage, the outward movement of the work can be controlled by the use of a fixture secured in either the tailstock or the toolblock. When tightening the jaws of the chuck on the work, consideration must be given to the weight and the rigidity of the part to be machined and to the pressure or strain of cutting.

Mr. Kiddle also suggests in his article that to adopt the plan outlined by Mr. Kugler of drilling holes in his chuck would mar its appearance and would soon render necessary the provision of a new chuck.

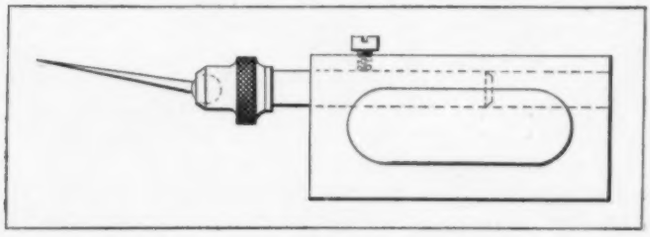
The large-size faceplates supplied with most of the lathes in use today, have many holes cored in them, the holes enabling the operator to clamp work to the faceplate that cannot be held in the chuck. One of the finest four-jaw chucks I have seen was liberally supplied with holes cored in the face. The jaws were not hardened and there was no sign of weakness while in use. This chuck was part of the equipment of an engine lathe supplied by one of the most prominent builders of machine tools.

If Mr. Kiddle is using a four-jaw independent chuck of a suitable design, he can carefully mark off and drill holes in it that will enable him to use the adjustable spacers suggested by Mr. Kugler, the adoption of which will cover a wide range of work and will give the required assistance and accuracy.

A Simple Tool for the Set-Up Man

J. RANDALL

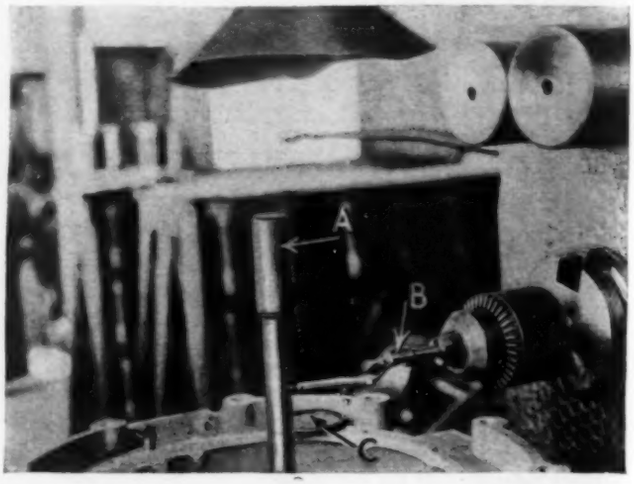
In the sketch is illustrated a simple and handy tool for setting-up work to a line. The device consists of a wiggler held in a hole in an iron or steel block by a set-screw. In setting the point of the wiggler to a line on the work, a slight push with the finger is all that is necessary. The block should be planed on the bottom and the sides should be recessed for finger grips.



Locating a Cross Hole

CLIFFORD H. FRENCH

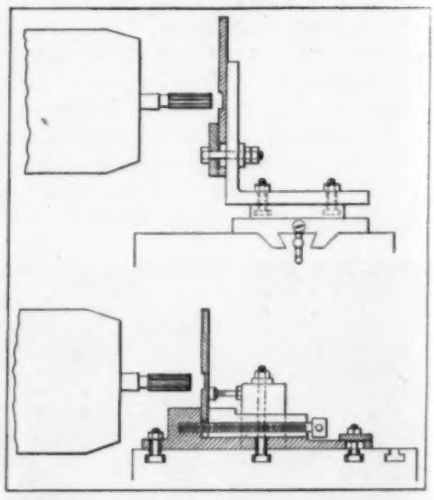
It was necessary to locate a cross hole so that is could be drilled into another hole right on its center line. The piece was a special crankcase, only part of which is shown. The plug *A* is a good fit in the first hole and was



placed in position as shown, and the case located as to angle of hole. Then the small indicator *B* was put in the drill chuck in the milling machine spindle, and the table moved until the plug was central with the spindle carrying the chuck. By turning the indicator half way round and adjusting the work until the indications showed half the diameter of the plug in both positions, the exact center of the hole was obtained. The small round pocket mirror *C* made it easy to read the indicator when it was turned so that the graduations came on the under side.

A Small-Shop Kink—*Discussion*

ARTHUR SILVESTER
Manager, The Iten Fibre Company



In an article under the title given above (*AM*—Vol. 75, page 898), Charles H. Willey describes the method he used for cutting one inch from the width of some $\frac{1}{8}$-in. steel plates and intimates that there may be an easier way of doing the work in a shop equipped with light tools only.

In the accompanying illustration are shown two methods for doing the work, either of which could have been used to good advantage. In the upper view, the work is mounted on an angle plate attached to the base of the compound rest of a lathe. Two cuts by a $\frac{1}{4}$-in. end

mill would remove enough metal to permit the two parts of the plate to be easily separated by breaking. The rough edge could be smoothed with a file.

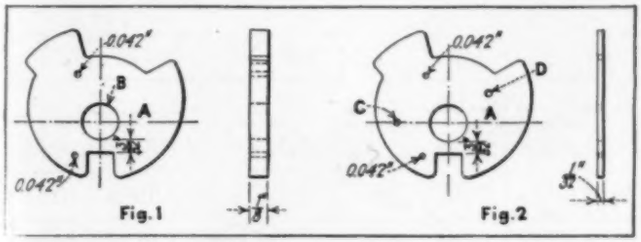
In the lower view, the work is shown held in the vise of a milling machine and is backed up by jack bolts abutted against blocks of wood bolted to the table on each side of the vise. A ¼-in. end mill is used to make the cut and the piece is broken from the plate, as in the previous case.

However, I believe that if the shaper were in first-class condition, the job could and should have been done in that machine, and the cost would have been far less.

A Redesign That Reduced Cost

C. H. HAYS

A cam-shaped piece used in a locking device on an X-ray apparatus is shown in Fig. 1, the part being blanked in progressive tools. The stock thickness is ⅛ in., making it impossible to pierce the two 0.042-in. holes or to maintain the $\frac{3}{32}$-in. distance *A* and at the same time have the hole *B* round. The sequence of operations was as follows: Blank in progressive tools; pierce hole *B*



small enough to be drilled or reamed to bring it to size and make it round; drill two 0.042-in. holes and redrill hole *B* to size, using a drill jig; carbonize and harden.

The redesigned part is shown in Fig. 2, the following changes being made: Stock thickness reduced from ⅛ to $\frac{1}{32}$ in.; material changed from cold-rolled steel to spring steel; and holes *C* and *D* added. The sequence of operations is now as follows: Blank the part in progressive tools, piercing all holes to size; harden and temper; rivet four blanks together to obtain ½-in. thickness, using holes *C* and *D* for rivets.

SEEN AND HEARD

JOHN R. GODFREY

Volume and Cost

Regarding the relation of volume to cost, the past experience of an automotive manufacturing executive is interesting. In 1926, his company was making door panels for 74 cents each with little profit on a 200 per day schedule.

Then production was jumped to 1000 per day, but the purchaser demanded a reduction in price. With much misgiving a price of 58 cents was given. But to the executive's surprise the company made more money on this order than ever before. The trick was turned by economic tooling.

Now with the toolmaker's ingenuity taxed to get out limited production at a cost at least as low as during the peak years, one wonders whether history will repeat itself. That is, will an increase in schedules mean a still lower cost? Why not?

Virtue in Brass Plates

In one plant we visit from time to time, they attach a brass plate to every machine installed. This carries the installation date, the serial number, the ledger number, and the cost of the machine in dollars. The executives make a particular point of having the operator understand clearly the amount invested in his machine. They find that their operators are impressed and are taking much better care of their equipment since they began to appreciate the investment involved. Incidentally we find that only 26 per cent of the equipment in this plant is over ten years old.

Hard to Crush

Those who are not familiar with the light alloys have little idea of the strength or stiffness of structures built up from them. I recently saw an all-metal airplane wing built of thin dural sheet being scrapped for remelting. It was laid on the ground and a fairly heavy wheeled tractor ran over it many times before it was flattened. The first few passes made little impression on it. Anyone who needs a light, stiff structure should consult designers of metal wings.

Machine Tools in Airplane Shops

Even though airplanes still have a large percentage of wood in their makeup, a surprising number of machine tools are to be found in the average airplane plant. Metal fittings of various kinds require shaping and drilling; pins, bolts, and shafts have to be turned; holes have to be punched and metal formed into different shapes. There is hardly a plant building planes without its machine shop containing lathes, drilling machines, a milling machine, shaper, punch press, bandsaw for metal, nibbler, and some sort of a brake for forming sheets. And in few cases are these tools of ancient vintage. If not new, they show little signs of wear and total more than might be imagined. In one plant of this kind, I counted eleven milling machines, of which only three were of the hand miller type. And there were other machine tools in proportion.

Hardened Bearing Surfaces

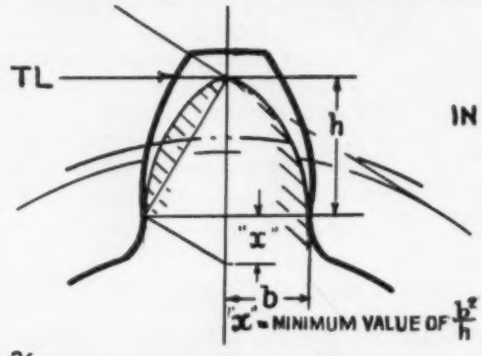
We generally mean to run hard and soft metals together for bearings but there are exceptions. The old high-speed grinding spindles had a hardened steel bushing in which they ran with almost no lubrication. Just a wipe of a kerosened rag was all the lubrication there was room for between the spindle and the bearing. The other day I saw a hardened piston pin running in a hardened steel bushing in the piston of a racing engine. The engine turns up over 6,000 r.p.m. at top speed, and the only lubrication was the splash from the lower end of the connecting rod, but of course, it splashes plenty at that speed. The crankpin bearing however was a thin lining of babbitt cast in the rod. Whether the hardened bearing would work on the crankpin is another story.

American Machinist
Reference Book Sheet

STRENGTH OF EXTERNAL SPUR GEAR TEETH

Values of *X* for 14½-deg. Involute Full-length Teeth

(AS BASED ON LEWIS FORMULA)



* ⅔ ULTIMATE STRENGTH FOR CAST IRON
⅔ ELASTIC LIMIT FOR STEEL

FORMULA:

$$TL = SFS \times FW \frac{2x}{3}$$

IN WHICH:

TL = TANGENTIAL TOOTH LOAD IN POUNDS
SFS = SAFE FIBRE STRESS
FW = FACE WIDTH IN INCHES
"x" = FACTOR (SEE ILLUSTRATION)

$$SFS = \frac{*FS \times 600}{600 \times PLV}$$

FS = FIBRE STRESS OF MATERIAL
PLV = PITCH LINE VELOCITY IN FEET PER MIN.

NUMBER OF TEETH	DIAMETRAL PITCH													
	2	3	4	5	6	7	8	9	10	12	14	16	18	20
	VALUE OF "x" IN INCHES													
12	.1489	.0993	.0745	.0596	.0496	.0409	.0358	.0318	.0286	.0239	.0204	.0179	.0159	.0143
13	.1574	.1049	.0787	.0631	.0524	.0434	.0381	.0338	.0305	.0254	.0217	.0190	.0169	.0152
14	.1666	.1110	.0832	.0667	.0555	.0462	.0404	.0359	.0324	.0270	.0231	.0201	.0179	.0161
15	.1726	.1151	.0863	.0692	.0575	.0480	.0420	.0373	.0336	.0280	.0240	.0208	.0187	.0167
16	.1772	.1181	.0885	.0710	.0590	.0493	.0432	.0384	.0346	.0288	.0247	.0215	.0192	.0172
17	.1820	.1212	.0909	.0728	.0606	.0507	.0444	.0394	.0355	.0297	.0254	.0221	.0198	.0177
18	.1877	.1251	.0938	.0756	.0625	.0523	.0458	.0407	.0367	.0307	.0263	.0230	.0204	.0183
19	.1938	.1293	.0969	.0776	.0646	.0543	.0475	.0422	.0381	.0318	.0273	.0238	.0212	.0189
20	.2009	.1339	.1005	.0803	.0669	.0563	.0492	.0438	.0395	.0329	.0283	.0247	.0219	.0196
22	.2087	.1391	.1043	.0835	.0695	.0586	.0512	.0455	.0410	.0343	.0294	.0257	.0228	.0204
24	.2161	.1440	.1080	.0864	.0720	.0608	.0532	.0473	.0426	.0356	.0305	.0267	.0237	.0211
28	.2215	.1476	1107	.0885	.0732	.0624	.0546	.0485	.0437	.0365	.0318	.0274	.0243	.0217
32	.2308	.1538	.1153	.0923	.0768	.0657	.0570	.0506	.0456	.0381	.0327	.0286	.0254	.0226
35	.2382	.1588	.1199	.0953	.0793	.0674	.0590	.0523	.0471	.0395	.0338	.0296	.0262	.0234
40	.2452	.1635	.1225	.0981	.0817	.0695	.0608	.0539	.0486	.0406	.0349	.0305	.0270	.0241
60	.2525	.1684	.1262	.1010	.0841	.0717	.0627	.0556	.0500	.0418	.0359	.0314	.0278	.0248
80	.2612	.1740	.1305	.1044	.0870	.0747	.0650	.0576	.0519	.0433	.0372	.0326	.0288	.0257
110	.2718	.1810	.1358	.1086	.0905	.0773	.0677	.0600	.0541	.0451	.0388	.0340	.0301	.0268
150	.2792	.1860	.1395	.1117	.0930	.0795	.0696	.0618	.0556	.0464	.0398	.0349	.0309	.0275
200	.2874	.1915	.1437	1150	.0957	.0820	.0718	.0637	.0573	.0478	.0410	.0360	.0319	.0283
RACK	.2940	.1960	.1470	.1176	.0980	.0840	.0735	.0653	.0588	.0490	.0420	.0368	.0326	.0290

Courtesy of Fellows Gear Shaper Company

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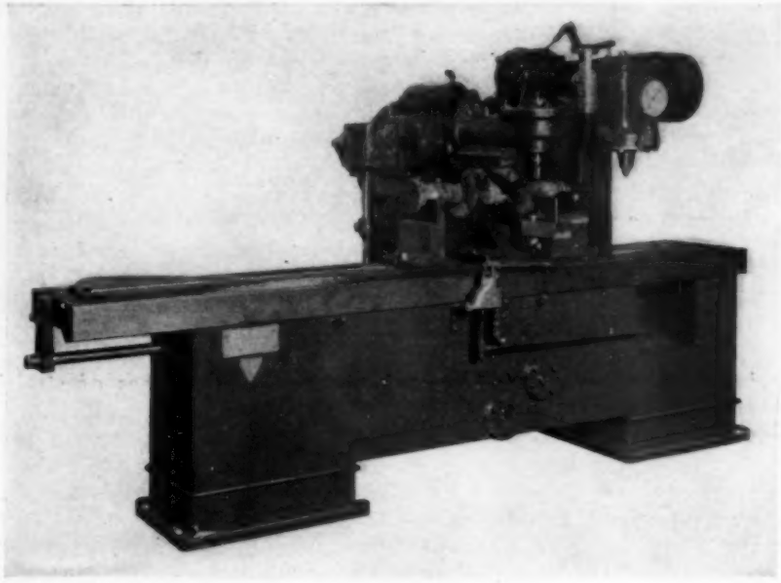
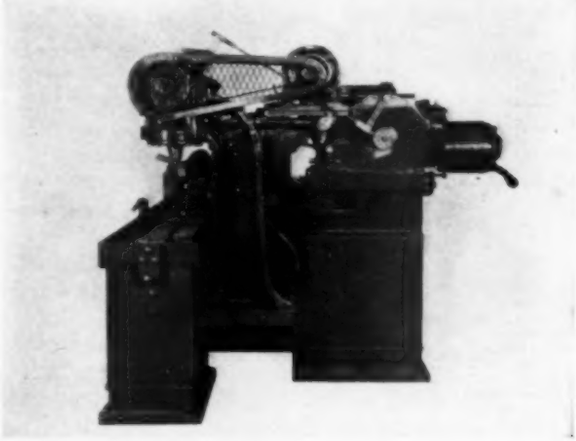
SHOP EQUIPMENT NEWS



Millholland Automatic Brinelling Machine

AN AUTOMATIC machine for testing the hardness of crankshafts and other forgings on a production basis has been produced by Millholland Corp., 1145 E. 22nd St., Indianapolis, Ind. The machine comprises a Millholland No. 4 milling unit used in conjunction with a Brinell testing apparatus. Except for loading and unloading the machine is entirely automatic in character. This feature, coupled with its ability to mill a stop for testing to the same depth each time, insures a uniform test of each piece.

The piece is chucked on a reciprocating work table while the table is at the extreme left end of its travel and clear of the milling cutter. The operator then depresses the starting valve, which starts the automatic cycle. The table advances to the milling station, where the milling unit mills the spot to be tested. The table then continues to the Brinell station where it dwells sufficiently long for an impression to be made . The Brinell apparatus is operated by a system of levers actuated by an auxiliary cam on the same shaft as the feed cam of the milling unit. After the Brinell pressure is released, the work table returns to its original position for unloading. According to the manufacturer, one man can handle approximately 100 cranks per hr., which enables him to test the entire output of a fairly large forging plant, since the holding fixture can be changed rapidly to accommodate different types and sizes of forgings.



Hanson Van-Winkle Munning No. 20 Galvanizing Flux

Molten zinc for galvanizing is usually held in steel kettles of various sizes and shapes, divided into at least two parts, one where the material to be coated enters the kettle and the second where it leaves. Over the first part of the kettle the surface of the molten zinc must be clean and free from zinc oxide. This is usually done by mixing a suitable flux. Hanson Van-Winkle Munning Co., Matawan, N. J., however, has developed its No. 20 galvanizing flux to create a satisfactory frothing flux economically without requiring other ingredients. The flux is claimed to include nothing that will damage the work, the molten zinc or the operator.

The frothing agent is self-contained so that there is no need for addition of bran, oatmeal, or other ingredients, thus avoiding the expense of warehousing and mixing it. It is suitable for all types of galvanizing, including wire and wire products. Where special jobs are encountered, its composition can be varied slightly to meet operating conditions.

The flux may also be dissolved in water to make a solution of suitable concentration to replace either the dilute muriatic acid or zinc chloride flux wash now often used just previous to galvanizing. In addition to performing the washing operation, the flux carries over into the molten zinc and aids in creating a suitable flux froth or reduces to a minimum the necessity for hand additions of the solid material.

The technique of the use of the flux is also new, according to the

manufacturer. It is introduced by small shovel-fuls at the place where the work enters. Thus only where it is essential is the flux new, and the partially or fully spent flux is automatically pushed back to those areas where its function is merely to act as a blanket to prevent formation of zinc ashes. The flux is claimed to show increased economy, to reduce fuming, to be dry, uniformly stable, and to eliminate "spitting" from moist work.

Rogers Type "K" Electric Utility Grinder

A combination bench grinder, designed for plants requiring an efficient but inexpensive machine, is now being manufactured by Samuel C. Rogers & Co., 191-205 Dutton Ave., Buffalo, N. Y. It is equipped with a table for face, surface, knife or die grinding, a tool rest for edge tool grinding, and an attachment for sharpening circular saws up to 22 in. in diameter. The machine will grind knives flat or concave bevel to any desired angle, or square. On special order it is obtainable equipped with a 10-in. disk grinding wheel and adjustable table, or with flexible shaft with outer bearing for housing an emery or polishing wheel.

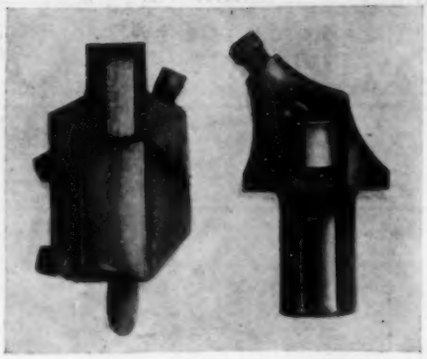
The operator can stop table movement at any point by placing the control lever in neutral, without stopping the grinder entirely. This permits, it is claimed, accurate work with the operator in complete control.

The base is column cored and cast in one piece. Bed, slide and knife table are rigidly mounted. Feed elements are within the base to lessen vibration. Height to the spindle is 18 in. The reversing mechanism is adjustable to suit the length of the knife being ground, and the cross-feed mechanism is controlled by two handwheels at the ends of the slide. Both the knife table and the circular saw carriage are adjustable and can be locked in any desired position. The hand feed of the saw holder to and from the grinding wheel has positive stop adjustments.

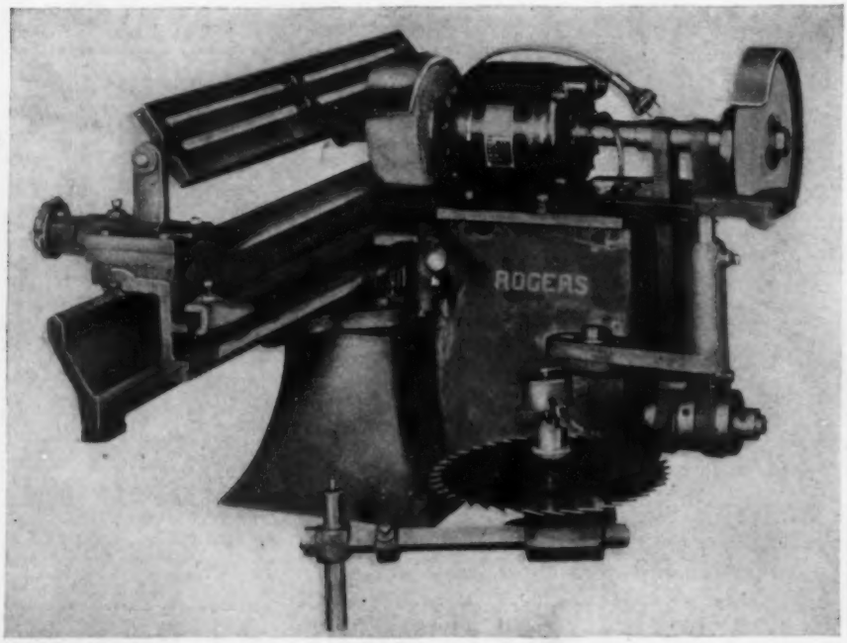
Regular equipment comprises a ⅓-hp., ball-bearing, single-phase motor with automatic end thrust take-up, toggle switch, cord and plug, internal belting, 6x3-in. cup grinding wheel, 8 x ½-in. tool grinding wheel, 8 x ¼-in. saw gumming wheel, saw gumming attachment and tool rest. A larger motor may be obtained if desired. Two sizes are available in three combinations, one size being 26 in. and weighing 380 lb., the second 32 in. and weighing 420 lb. The combinations include various types of additional equipment.

"Four-Grip" Tool Bit Holders

An angular clamping arrangement that clamps the tool bit in the V formed by the two opposite sides is the feature of the "Four-Grip" line of tool-bit holders manufactured by Four Grip Tool Co., 107 East Seventeenth



St., Paterson, N. J. A V-block and setscrews of heat-treated alloy steel are set at 45 deg. to the vertical centerline of the tool, thus causing the V-block to clamp against the corner of the bit rather than against the top or side as in usual holders. This is claimed to provide more solid backing and a clearer view of the cutting edge of the tool. Straight-shank, cutting-off, combination planer, combination shaper, planer goose-neck, and vertical boring mill straight-shank holders are available to fit standard sizes of tool bits. Larger sizes of straight-shank holders are equipped with double clamping screws, and right- and left-hand facing types are available. Cutting-off holders are available in straight-shank, and right-hand or left-hand offset types. Vertical boring mill holders have either a left- or a right-hand offset screw. The combination planer, or PL, type has two parts, the shank containing an octagonal socket, which may be permanently clamped to the railhead, and the head, which has an octagonal shank and is movable to obtain desired cutting positions. The combination shaper, or SH, type is similarly designed. These are shown in the accompanying illustration, which shows at left the cutter head and shank assembled and at right the bit holder head with its octagonal shank.



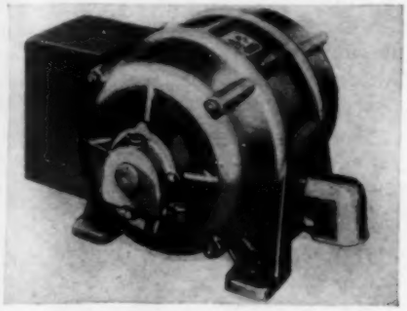
Graton & Knight "Research" Leather Belting

A new type of leather belting in which permanent stretch is claimed to be practically eliminated has been developed by Graton & Knight Co., 356 Franklin St., Worcester, Mass., and is being marketed under the trade name "Research." The change is made by a new process of manufacture which is claimed not to weaken the leather but to give it 15 per cent increased strength, yet practically no

permanent stretch. The new leather also is claimed to have a much higher friction surface than ordinary belting leather and to be decidedly more flexible. A bulletin with descriptive engineering and application data is available from the company.

Noel Polyphase Capacitor Motor

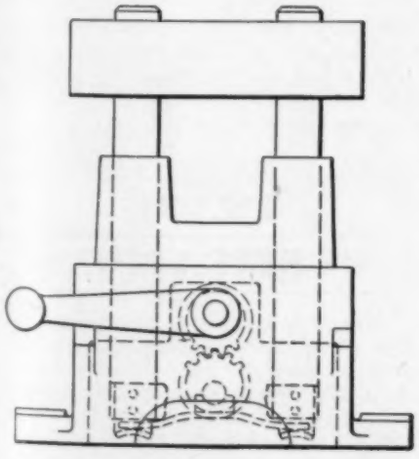
Improved starting and running characteristics are found in the Noel polyphase capacitor motor announced by The Ideal Electric & Mfg. Co.,

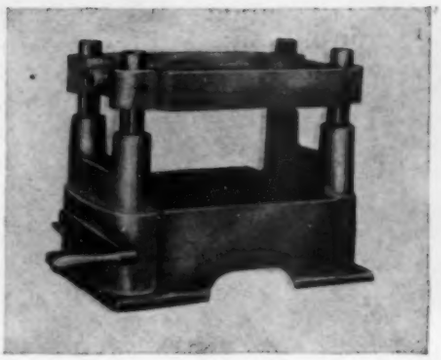


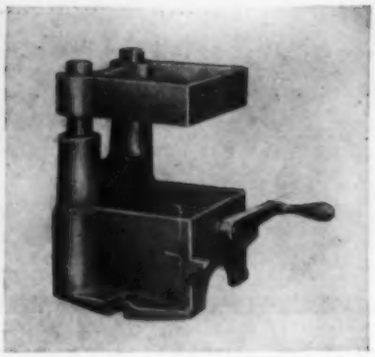
Mansfield, Ohio. Instead of applying capacitors across the motor terminals and thereby producing a high power factor only in the power line, in this motor the condenser reactive current is caused to flow through the windings and thereby produces a high power factor within the motor itself. The motor operates at practically unity power factor at all loads.

Modern Drill Fixtures

New types of 2-post and 4-post drill fixtures with radically different clamping arrangements are being manufactured by Modern Engineering Service, 7 E. Grand Ave., De-







troit, Mich. Contrary to usual practice, the guide pins are positioned and are held by set screws in the top platen instead of the lower. The clamping mechanism consists of two eccentric gears, one mounted on the clamping handle and the other meshing with it and mounted so that it depresses a curved flat spring, or springs, depending on whether the fixture is a 2-post or 4-post type. The ends of the spring or springs are fastened to the bottom of the guide pin. Thus the two eccentric gears in the spring mechanism raise and lower the bushing plate and apply the desired spring pressure directly on the guide post, which in turn clamps the work through the bushing plate. Bushing plates are easily adjusted and permit any desired pressure on the work. After the bushing plate is once put in the desired position, the spring clamping device will allow work variation of $\frac{1}{16}$ in. The entire operating mechanism is inclosed in the base in order to keep out chips and dust. Operating handles are of steel. Suitable provisions are made for chip clearance.

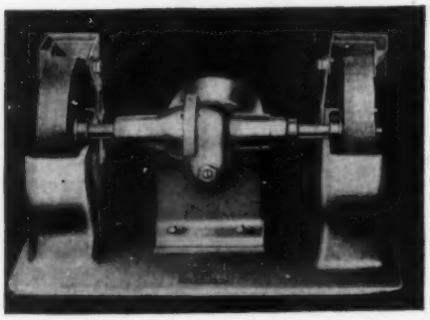
The 4-post fixture is claimed to insure perfect alignment of bushing plates and to prevent tipping regardless of the point where working pressure is applied. The 2-post fixture is otherwise similar in design. Both types are available in aluminum at slightly increased cost and either type can be furnished completely tooled, if desired. Special designs are available, though ten standard sizes of the 2-post type and eleven of the 4-post type are manufactured.

Pike Nos. 50 and 60 Motor-Driven Oilstones

The time-honored process of oilstoning is now electrified by Pike Mfg. Co., Pike, N. H., to produce final finishes on cutting edges of tools. Both machines here described are essentially just power and speed applied to conventional oilstones. They are portable and powered with universal motors that operate from any light socket. They are equipped with gravity oil feeds, and with felt wipers which supply the right

amount of oil to lubricate the oilstones properly and to float metal particles, thus preventing glazing and maintaining unimpaired the cutting qualities of the stone.

India oilstones, in different grits, are standard on Pike powered oilstones. For special oilstoned finishes Washita or Arkansas oilstones may be secured as additional equipment. The No. 50 power bench stone and the No. 60 power oilstone are illustrated. The No. 50 will handle all tools with broad, flat edges, like chisels, plane irons, box and bearing scapers, molder knives, and machinists' scrapers. Standard equipment includes one medium India oilstone, universal motor, gravity oil feed, extension cord with plug, and a can of oil. Six other grades of oilstones and cast-iron lapping disk are available as extra equipment. The stone of one grit may be changed easily for that of another without the use of a wrench. A cast-iron lapping disk is supplied for use with

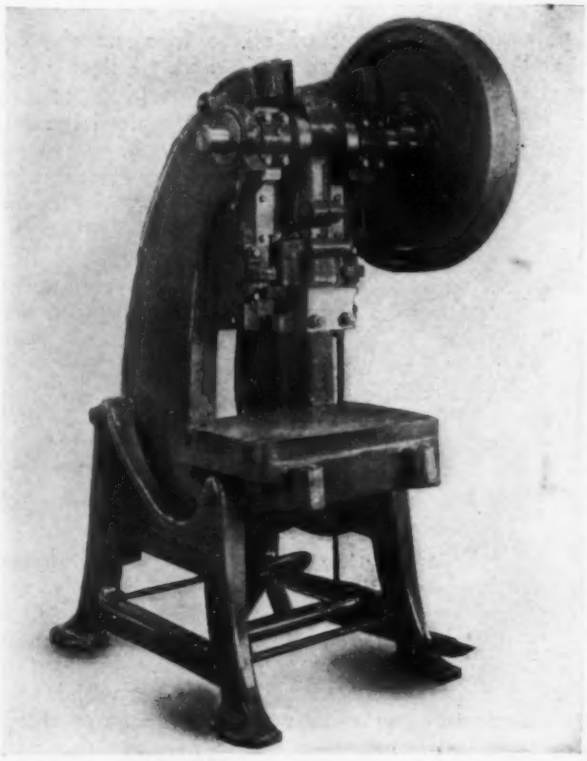


various lapping powders for fine surface lapping.

The No. 60 power oilstone was developed to put an oilstone finish on a variety of cutting tools, the edges of which are of such shape or so located they cannot be oilstoned on a regular bench stone. This machine is not a tool grinder; its only purpose is to put an oilstone finish on edge tools. It is supplied with one coarse and one fine India oilstone, two gravity oil feeds, universal motor, 8-ft. extension cord and plug, and a can of stone lubricating oil. Seven additional grades of oilstone are available.

Loshbough-Jordan No. 4½ Open-Back Inclinable Press

A new open-back inclinable press has been added to the line of Loshbough-Jordan Tool & Machine Co., Renn St. & Sterling Ave., Elkhart, Ind. It will be known as the No. 4½ and will be made in three styles, flywheel, geared and combination geared. The flywheel type is capable of delivering approximately 40 tons pressure to the bottom of the ram. The press is built especially sturdily throughout, and, according to the manufacturer, has these advantages: Large die space, deep throat, large bolster plate area, large opening in bed, large opening in back and bedplate low when inclined, making it desirable for a wide variety of press work. This is but one of several new models the company is bringing out.

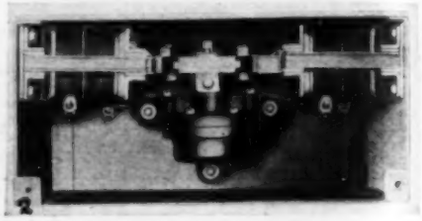


Hannifin Electrically Operated Air Valves

Three types of electrically operated air valves are being manufactured by Hannifin Manufacturing Co., 621 S. Kolmar Ave., Chicago, Ill. Model C valve, Fig. 1, is furnished in both single and double types for remote control of either single or double-acting air cylinders. This valve unit can be operated from one or more push-button stations. One common use of the valve is in controlling air cylinders that engage and disengage clutches on large machinery where it is desirable to enable the operator to control the starting and stopping of the machine from a number of stations. When the circuit is broken, the cylinder is open to exhaust.

Model D valve is designed for time-cycle operation or remote control of an air cylinder. It can be operated manually from a push-button station or automatically with an electrical time-cycle unit. The unit consists of an electrically-operated pilot valve, a single-acting valve-operating air cylinder, and a standard air control valve. Closing the electric circuit causes the pilot valve to admit air to the valve-operating cylinder. This in turn operates the air-control valve, thus admitting air to one side of the power air cylinder. Breaking the circuit releases air from the valve-operating cylinder, which being a single-acting, spring-return type, reverses the air-control valve, thus admitting air to the opposite side of the power air cylinder. This valve unit is designed for operating cylinders of 8-in. bore and larger where the power stroke is to be held for a short period. It can be furnished with ¼-, ½- and ¾-in. operating valves.

Model E, Fig. 2, is claimed to meet a majority of industrial requirements for 4-way control of double-acting air cylinders. It provides instantaneous push-button control of cylinders from one or more stations. Pressing the start button operates the cylinder in one direction. Pressing the stop button reverses the cylinder, which is always under air pressure at one end or the other. The operation of the valve is instantaneous so that only momentary contact of the push button is required, and the circuit is closed only when one of the push buttons is depressed. This valve may also be arranged for automatic time-cycle operation. It is made in two sizes with ¼ or ½-in. pipe connections.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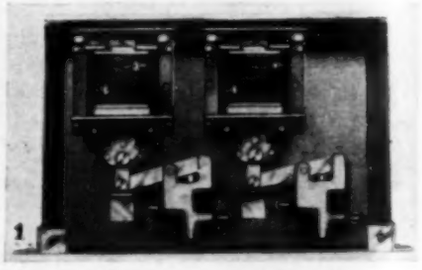
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All three types of valves are furnished for operation on a.c. or d.c. circuits, either 110 or 220 volts, except Model D, for 110 volts only.

• TRADE • PUBLICATIONS

METAL STATISTICS. 25th annual edition of this handbook, issued by *American Metal Industry*. Includes figures on production price, exports, imports, etc., of coal, pig iron, steel and products, copper, lead, zinc and tin.

MOTORS. Monitor Controller Co., Baltimore, Md., has issued a bulletin on the Monitor accelerator for starting d.c. motors, explaining the "electro-magnetic" balance principle of the accelerator.

HEATING UNITS. General Electric Co., Schenectady, N. Y., has issued Bulletin A-1520 on "Electric Heating Units & Devices," a mail-order catalog of small electric elements of the type indicated.

LEAD-COATED COPPER. Copper & Brass Research Association, 25 Broadway, New York City, has published Circular 12-C-53, on Lead-Coated Copper, giving methods of specifying, applying, inspecting and fabricating. It is planned as a folder for Copper & Brass Research Bulletin No. 69, dated Feb. 1, 1932, on the same subject.

POWER SQUARING SHEARS. Niagara Machine & Tool Works, Buffalo, N. Y., has issued Bulletin No. 71-D, describing Niagara power squaring shears, Series Nos. 10-100-200-500, with capacities of No. 14 gage soft steel and lighter. The bulletin includes photographs and specfications of all the company's units in this group.

• PATENTS •

APRIL 5, 1932

Tools and Attachments

Greasing Apparatus. Conrad R. Buchet, Long Beach, Calif., assignor to Alemite Corporation. Patent 1,852,001.

Arc-Welding Electrode. Wilber B. Miller, Flushing, N. Y., assignor to Oxweld Acetylene Co. Patent 1,852,021.

Wrench. Ernest W. Crocker, Duchesne, Utah. Patent 1,852,075.

Laminated Spring. Heinrich Sieprath, Aachen, Germany. Patent 1,852,132.

Diestock. Ira W. Nonneman, Warren, Ohio, assignor to The Borden Co. Patent 1,852,186.

Jig Saw. Frank E. Schneider, Oswego, N .Y. Patent 1,852,193.

Nut. George C. Easter, Baltimore, Md., assignor to The Vulcan Steel Products Co. Patent 1,852,203.

Tap Wrench. Herbert J. Smith, Greenfield, Mass., assignor to The Threadwell Tool Co. Patent 1,852,220.

Apparatus for Dressing Circular Saws. John A. Waller, Beverly Hills, Calif., assignor to Waller Manufacturing Corporation, Ltd. Patent 1,852,276.

Removable Grip for Tool Holders. Alfred W. Gelpcke, Brooklyn, N. Y., assignor to The Rawlplug Co. Patent 1,852,296.

Actuator for Controlling Devices. Louis A. M. Phelan, Elkhart, Ind., assignor to Minneapolis-Honeywell Regulator Co. Patent 1,852,333.

Pipe-Cutting Torch Support. Daniel W. Hickey, St. Paul, Minn. Patent 1,852,413.

Inclosed Convertible Motor. George T. Pfleger, Los Angeles, Calif., assignor to United States Electrical Manufacturing Co. Patent 1,852,476.

Heat-Treatment Mechanism. James A. Kinney, Lebanon, Pa., assignor to Bethlehem Steel Co. Patent 1,852,528.

Apparatus for Closing and Clamping Split Rings about a Mandrel. Emil A. Koether, Baltimore, Md., assignor to The American Hammered Piston Ring Co. Patent 1,852,529.

Damping Means for Gear Wheels. Rudolph E. Peterson, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Patent 1,852,538.

Clutch. Alpheus W. Altorfer, Peoria, Ill., assignor to Altorfer Brothers Co. Patent 1,852,552.

Saw. Charles R. Kittle, Elsinor, Calif. Patent 1,852,616.

Grinding Wheel Dresser Tool. William D. Bartlett, Cleveland, and Daniel Kelleher, Berea, Ohio, assignors to The Ross Manufacturing Co. Patent 1,852,639.

Continuous Washing and Drying Machine for Blue Prints and the Like. Thomas Lord and Harold J. Brunk, Chicago, Ill., assignors to C. F. Pease Co. Patent 1,852,662.

Mechanical Hammer. Herman Nielsen, Frederiksberg, by Copenhagen, Denmark. Patent 1,852,668.

Reamer. Lawrence O. Beard, Lancaster, Pa. Patent 1,852,690.

Material Handling Apparatus. William Schroeder, Orange, N. J., assignor to Western Electric Co. Patent 1,852,758.

Portable Universal Power Tool. Walter L. Hodeaux, West Palm Beach, Fla. Patent 1,852,776.

Damping Means for Gear Wheels. Rudolph E. Peterson, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Patent 1,852,789.

Welding and Brazing Rod. Norman S. Harrington, Cleveland, Ohio, assignor to General Electric Co. Patent 1,852,847.

Brake, Electrically Actuated. Edgar Price, Schenectady, N. Y., assignor to General Electric Co. Patent 1,852,857.

Self-Locking Nut, Washer, and the Like. Joseph Ernest Colas, Paris, France. Patent 1,852,919.

Burner for Autogenous Fusing and Welding Under Water. Harry Töpper, Berlin, Germany. Patent 1,852,946.

Gear. George A. Dalton and John R. Dunham, Highland Park, N. J. Patent 1,852,957.

Metal-Working Machinery

Conveyer System. Herbert E. Twomley, Riverside, Calif., assignor to Clara B. Parker. Patent 1,852,034.

Gang Borer. Judson H. Mansfield, Rockford, Ill., assignor to Greenlee Bros. & Co. Patent 1,852,124.

Apparatus for Welding Tube Connections. Rufus R. McKnight and Arthur Webber, Chicago, Ill., assignors to The Demoe Engineering Laboratories, Incorporated. Patent 1,852,180.

Rotary Flying Shear Mechanism. Florence C. Biggert, Jr., Crafton, Pa., assignor to United Engineering & Foundry Co. Patent 1,852,282.

Combination Woodworking Machine. William B. Long, Punxsutawney, Pa., and Fred C. Arey, Oak Park, Ill.; said Arey assignor to said Long. Patent 1,852,324.

Woodworking Machine. Louis Wieden, Livermore, Calif. Patent 1,852,387.

Wire Bending Machine. Frank Bergandi, Los Angeles, Calif. Patent 1,852,396.

Sheet Metal Cutting Machine. Francis J. Moore, Minneapolis, Minn. Patent 1,852,534.

Hardening Apparatus. Fred E. McCleary, Detroit, Kurt C. Babo, Clawson, and Harry Rayner, Detroit, Mich., assignors to Chrysler Corporation. Patent 1,852,621.

Drilling or Tapping Machine. Edwin L. Connell, Cleveland, Ohio, assignor to The Van Dorn Electric Tool Co. Patent 1,852,736.

Electric Welding Apparatus. Walter Reginald Hume, Melbourne, Victoria, Australia. Patent 1,852,781.

Automatic Lathe. William A. Bohne, Philadelphia, Pa., assignor to E. F. Houghton & Co. Patent 1,852,915.

Processes

Article of Manufacture and Process of Making It. Lloyd Smede and Errol B. Shand, Pittsburgh, Pa., assignors to Westinghouse Electric & Manufacturing Co. Patent 1,852,093.

Metal Working. Parker F. Wilson, Wheeling, W. Va. Patent 1,852,765.

Worm Gearing. Ernest C. Head, Rochester, N. Y., assignor to Gleason Works. Patent 1,852,775.

Chromium Plating Process. David Julian Block, Chicago, Ill., assignor to Apollo Metal Works. Patent 1,852,797.

Nut and Method of Fabrication and Assembly. Edward W. Mitchel, Detroit, Mich., assignor to F. L. McLaughlin Co. Patent 1,852,978.

Furnaces

Inductor Type Furnace. Edward Fitch Northrup, Princeton, N. J., assignor to Ajax Electrothermic Corporation. Patents 1,852,214 and 1,852,215.

Regenerative Heating Furnace. George H. Isley, Worcester, Mass., assignor to Morgan Construction Co. Patent 1,852,306.

Furnace. James L. McFarland, Schenectady, N. Y., assignor to General Electric Co. Patent 1,852,816.

Materials

Zinc-Base Die-Casting Alloy. Willis M. Peirce and Edmund A. Anderson, Palmerton, Pa., assignors to The New Jersey Zinc Co. Patent 1,852,434.

Zinc-Base Die-Casting Alloy. Edmund A. Anderson and George L. Werley, Palmerton, Pa., assignors to The New Jersey Zinc Co. Patents 1,852,441 and 1,852,442.

American Machinist
Reference Book Sheet

PRESENT-DAY PICKLING PRACTICE

ACIDS commonly used in pickling are: sulphuric for its cheapness and ease of handling, muriatic for its faster pickling and reduced pitting action; hydrofluoric to remove sand; nitric for alloy steels, non-ferrous metals and alloys and for the passivation of chrome steels.

Tanks and Room

Metal construction in a pickling room should be coated with pitch or acid-resistant paint. Good wooden tubs can be constructed with 6x6-, 6x8-, or 8x8-in. timbers painted with thick white lead, rabbeted and held together with bronze, Monel metal or copper bolts, and lined with replaceable walls and bottom of 1-in. cypress or white pine locked in place with copper nails. Monel metal or stoneware tanks are also used.

Steam hammering, resulting from the use of open-end steam pipes for heating the pickling bath, will cause vibration and leakage. It can be prevented by using a Duriron inductor, by running the line to the bottom, by using a perforated pipe, or by increasing the number and decreasing the size of steam inlets. Traps should be used to remove condensation to prevent excessive dilution.

Cleaning Castings

One part hydrofluoric acid, one part 20-deg. Bé. muriatic acid, and six parts water are used in cypress tank at 125 to 133 deg. F. for cleaning castings. The muriatic removes the rust and scale and saves hydrofluoric acid. Pickling time is about 45 min. to one hour.

General Scale Removal

Sulphuric baths from 3 to 12 per cent, at temperatures from 120 to 180 deg. F. and pickling times of 30 to 45 min., are used for general scale removal. The tendency today is to use larger equipment, which permits use of low acid strength, low temperature, and longer pickling time, thus insuring uniform pickling with less danger of burning, pitting, and wasting of metal. Where ideal conditions of capacity are present 4 to 6 per cent acid at 150 deg. F. and 30 min. time give best results. Acid and iron content may and should be carefully controlled. When operating with a 6 per cent acid solution, the iron content is allowed to grow to about 5 per cent. Standard capsules or tablets are available for checking acid and iron content.

Muriatic acid of 15 per cent solution is generally used in pitch-treated wooden tanks at 100 to 130 deg. F. for pickling time of 30 minutes.

Acid Consumption

Acid consumption varies with the area pickled and the thickness of scale. Agitation of work or bath is essential to obtain thoroughly and uniformly pickled articles.

High-Chrome Steel Pickling

Representative pickling solutions for high-chrome steels are: 55 parts of 20 deg. Bé. muriatic acid, 5 parts of 42 deg. Bé. nitric acid, and 40 parts of water, or 5 parts of 20 deg. Bé. muriatic acid, 5 parts of 42 deg. Bé. nitric acid, 16 parts of 66 deg. Bé. sulphuric acid, and 74 parts of water.

The nitric acid passivates the metal to a large extent against action of sulphuric and muriatic acids. Temperatures generally used are 150 to 160 deg. F. After rinsing, the work should be passivated in 20 per cent actual nitric acid for 30 min. at 150 deg. F. If the work is not passivated, much of it will not be stainless.

Inhibitors

Only within the last five or six years have efficient inhibitors been developed (page 906, Vol. 75). These are organic compounds and usually have a nitrogen base. They are colloidally dispersed compounds carrying electric charges which form some sort of film over the bare cathodic metal and prevent attack of the acid on the metal but do not effect the attack on scale. Some inhibitors now on the market reduce the action of acid on the bare metal to less than 1 per cent of that obtained when no inhibitor is used. Tests of efficient inhibitors showed 91.48 per cent inhibition with 0.01 per cent of inhibitor (but decreasing rapidly with time) and 99.1 per cent inhibition with 0.025 per cent inhibitor.

Advantages of using these inhibitors are: (1) Acid spray practically eliminated, thus improving working conditions and decreasing building and equipment deterioration; (2) Waste of metal is eliminated; (3) Pitting is prevented; (4) Life of bath is prolonged because less metal is dissolved; (5) Absorption of hydrogen in the metal, the cause of acid embrittlement, is largely eliminated; (6) Over-pickling or burning is prevented; (7) High-quality work without skilled workmen is insured.

Grease Removers

Discussion brought out that of the grease removers, metasilicate of soda is probably the most efficient due to the fact that it gives an emulsion of oil particles surrounded by water films and prevents the formation of an oil scum at the top of the bath.

Abstracted from a talk at the January Meeting of the Hartford Chapter, A.S.S.T., by O. L. Thomas, Technical Director, Grasselli Chemical Co.

Previous reference book sheets on pickling appeared on page 313, Vol. 72, page 437, Vol. 75, and pages 905 and 906, Vol. 75.

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EDITORIALS

April 14, 1932

K. H. CONDIT • F. H. COLVIN
Editors

A Four-Year Budget

All right—let's balance the budget. The President wants it, the House wants it and there are good arguments in favor of it. Failure to do so means government issues to meet current expense, a potential burden on the already soft bond market. Admittedly, this is undesirable. But the fiscal machinery forcing the balancing of the budget on a one-year basis might well be replaced by a more modern set-up.

A four-year budget concurrent with each presidential administration would avoid this difficulty. Reserves accumulated in prosperous years would fill the gap created by falling tax returns. Business and individuals would be relieved of an increase in burden when they can least afford it. Washington has urged business to plan on a long-term basis. But what business is in a better position for long-term planning than Washington?

At the present stage of affairs, perhaps this idea can only go into our memorandum book of things-to-do-during-the-next-boom. But certainly we need not be so calendar-minded that our national financial program must be crammed into a twelve-month period.

Machinery and Unemployment

What is the real measure of unemployment today in the light of the advances in productive machinery since the war? Here and there around the country, we find some plants that are lucky enough to be working full time. Actually a few more fortunate ones are working overtime. But for the most part factories and shops of all types and sizes are running on a short-time basis and frequently with only part of the normal working force.

We have seen a lot of figures on percentages of capacity, percentages of man-hours during the past two years, but are these really useful figures in view of new conditions? What today is normal capacity? What are normal hours of labor, and what are normal numbers of employees? This depression is an excellent time to consider these items carefully, so that our industries can start off on the right foot when business does increase. More than that, the proper solution and agreement as to what is normal might so coordinate matters that it would help to get the wheels of industry started again.

We know that fifteen hours a day was once considered a normal working period—that was when one operator in a textile mill ran one or two looms instead of sixty to a hundred. Before the war a 55- or 60-hour week was normal, but all machinery has been improved since then, and methods of production have been mechanized and speeded up. A survey made in 1930 showed that 38,000 establishments in this country were definitely on a 5-day week basis, indicating the willingness of many manufacturers to cut hours of labor to conform with machinery advances even in the face of competition from those who were not. Is it not time for all manufacturers to get together and agree to a definite short day and short week that would take up much of the slack of unemployment, give greater security of employment, and incidentally give workmen more time to buy and to use the products of this machine age?

Five Hundred Fifty

Not so long ago an outspoken, unsuccessful and, we suspect, disgruntled contributor wrote us that our articles were written by a bunch of swivel-chair mechanics and near-sighted near-editors—that a bona fide church-going shop man didn't have a chance, etc., etc. If we had had an Amos or an Andy on the staff we would have

asked him to say "A-Wa! A-Wa!" for us, and let it go at that.

But having neither Amos nor Andy we made a careful check and double-check of all the contributors whose writings were accepted, published and paid for during the single year 1931. The total may surprise you as much as it surprised us —550. Some of their articles were short, and many were long. But, we can hardly believe it ourselves, 550 separate, distinct and individual reader-contributors wrote them. No one needs to tell them why the metal-working industry swears by *AM*. We thank them one and all, including the outspoken contributor who called us names.

CHIPS

Taking their cue from the average citizen's only answer to reduced income, President Hoover and the House economy committee agree on expense cuts . . . estimated Federal savings 160 to 210 millions . . . Work on Hoover dam may be delayed by appropriation curtailment . . . Senate strives to untangle tax bill dumped on it by the House . . . Log rollers prepare to tack on tariff amendments . . . Secretary Mills assails levies on corporations and stock transfer . . . In Glass bill hearings, Reserve Board approves united banking . . . disapproves deflationary clauses . . . 1,200 veterans parade Washington . . . present 2,000,000 name petition for cash payment . . . though Legion national commander and many posts condemn demand.

Railroads win first step in their 12-year fight to kill recapture clause in the Transportation Act . . . House committee to recommend retroactive repeal . . . Despite the protest of Secretary Stimson, House votes to free Philippines . . . 13,000,000 persons would gain independence eight years hence . . . With Presidential approval, Senate starts its much-heralded stock exchange inquiry with emphasis on short selling . . . Whitney testifies . . . Wall Street blames bear market on Congressional confusion regarding tax program . . . Discontinuance of Shipping Board recommended by President . . . with transfer of functions to Commerce Department.

U. S. exports of industrial machinery in February rose 21 per cent over January . . . still about half of 1931 figure . . . Metal-working group made the best showing . . . $1,567,463 against January's $949,926 . . . Business failures hit new 1932 low . . . Pennsylvania's $10,000,000 appropriation to the jobless upheld by State Supreme Court . . . At the close of 1931, liquid position of 468 industrial corporations was more than twice as strong as a decade ago . . . Current asset to liability ratio for 1931, 38.2 to 1 . . . for 1921, 1.87 to 1.

By 6,000,000 votes over Hitler, Hindenberg continues German presidency . . . will be 91 if and when he completes 7-year term . . . Danube remains blue as parley agrees to disagree . . . conferees in no mood to compromise . . . Too many international confabs anyway says Grand Council of Fascism . . . recommends quick settlement of debts and reparations . . . Soviet Commissioners authorized to buy $2,500,000 worth of machinery and equipment in U. S. . . . Coal output in Donetz Basin falls . . . inefficient organization of labor blamed . . . Steel mills and metal-working plants feel effect of fuel shortage . . . Amo plant at Moscow, two tractor plants at Stalingrad and Kharkov in peril of closing . . . breakage of tools excessive . . . Seventeen engineers and foremen from U. S. Ford plants arrive at Nizhni Novgorod to reorganize.

> United Action Drive to put one million men to work announces 470,402 employed to date in 2,371 towns and cities . . . 57,986 over last week's figure.

Secretary Stimson sails for Geneva as arms parley gets under way . . . Canadian budget balanced by expense cut of $25,000,000, tax increase of $55,000,000 . . . Chile establishes martial law as cabinet is overthrown . . . Russo-Japanese war cloud hangs on horizon . . . Japs deny they will quit League but have 50,000 troops in Manchuria and Korea . . . British duties may rise with 33-1/3 per cent on steel recommended.

Union Pacific puts 1,000 men on maintenance work in Nebraska . . . Otis Electric receives $150,000 order from City of Philadelphia . . . Road construction in Schenectady uses 700 men . . . N. Y. Central shop at Cleveland employs 750 . . . Ford assembly plant at Atlanta takes on 600 . . . Los Angeles plant of Firestone Tire adds 250 to payroll . . . Industry awaits result of auto sales drive . . . Packard receives Collier trophy for development of the airplane diesel . . . Knitting machinery makers profit by swing to mesh hosiery.

· REGIONAL · REPORTS ·

OPTIMISM dies hard. Despite reports of dullness from all over the country few sections are without their complementary brighter outlooks. The auto sales drive, final results of which are not yet definitely known, has stimulated some orders and is expected to produce a few more. Navy lists continue to appear, lending heart to dealers and builders otherwise hard pressed to make a few close-bargained sales.

NEW YORK completed another fairly dull week. A few small sales to industrial plants, bids entered for Navy list, and slightly improved feeling about it all — thus went the week. A fair average of New England's shops find occupation filling orders from Ford. General activity remains low. Massachusetts employment up 4.8 per cent. Reports of satisfactory storm-riding by aviation industry. Cincinnati's business vein peters out but dealers and machine makers keep on digging in hope of striking richer lode. Inquiries lend encouragement in Indianapolis where railroad shops have recalled men for good stretch of work. Detroit, of course, is all abuzz with automotive interest. Low priced car sales, reported good, have resulted in a few machine sales and dealers, optimistic, look for more. Chicago appears pretty much down in the dumps with little or no sign of improvement.

NEW YORK—At least one sale as direct result of auto activity, not a little business from Navy, and in general slightly better feeling among most dealers were week's developments. Several small sales of single tools to industrial concerns also reported. Some dealers report week flat, most found inquiries improving with prospects of sales perhaps trifle better. Bids opened on list of about 15 tools for State School at Oswego. More Navy lists out. Dealers making bids.

NEW ENGLAND—Machine tool market quiet. Orders during week of no outstanding importance. Ford continues center of favorable expectations. Fair average of plants occupied with orders from this source, but level of general activity remains low. Navy continues to circulate inquiries steadily. Latest lists, scheduled to close April 19, 20 and 29, include single machine tools and other equipment. Since first of year industrial employment has shown improvement. In Massachusetts 4.8 per cent more help was employed during February than in January. Aeronautical industry riding depression satisfactorily.

CINCINNATI—Machine-tool business vein about pinched out, but increased number of inquiries gives manufacturers and selling agents hope of striking richer lode if they keep on digging. Orders booked came from general machinists and miscellaneous users whose requirements with few exceptions were confined to single tools. A few faint signs of improvement appear on horizon.

CHICAGO—Barometer of business sentiment in this district still dropping. Each week finds dealers and manufacturers representatives in worse funk than before. One tool maker's sales for month not enough to pay for rent. Building and loan association bonds offered in pay for an expensive machine. Westinghouse, with large elevator order to fill, adds another tool to those bought recently, may need more.

DETROIT—Motor car industry, stimulated by long-expected showing of new Ford cars, has experienced a revival that may soon be reflected in machinery and machine tool trade. Thus far there has been no advance in equipment field but time has been short and dealers are not altogether pessimistic about results. A few orders for small tools and for occasional machines, have been received. Large-scale changes in at least two popular cars within next six months are rumored. Inquiries not yet sent out. Sales in low-priced car field encouraging to general business. Large orders for materials placed and awaiting release. If released soon they will furnish employment to hundreds of thousands of men throughout the year. Contract jobbing shops, doing work for automotive plants, have received few orders but expect increase soon. Chrysler has reached production of 900 a day on new Plymouth. If figure goes much higher will probably be compelled to farm out some of the work and also may be forced to buy new equipment. Ford not yet tooled for heavy production. Chevrolet, making every effort to get its share of low-priced car sales, will probably be in the market for some equipment, perhaps much. No multiple sales this year but only occasional or replacement installations. Business from 10 to 20 per cent of normal, based on 10-year average.

INDIANAPOLIS—Inquiries during past two weeks have given some encouragement to machinery men in this section. Small tools of most interest. Inquiries chiefly from smaller machine shops most of which appear to be getting some business. Railroad shop employes back at work. Roads not buying equipment, however. No lists out at present. Some call for equipment for airports and some for garages. Road construction contractors rent machinery rather than invest capital. Some used machinery sold at cut prices.

MATERIAL TRENDS AND PRICES

New business in steel shapes, plates and bars is too small to offer a suitable test for the new maximum asking price of $1.60 per 100 lb., base, Pittsburgh. Anticipated increase in volume of demand has developed neither in automotive nor railway materials. Price changes continue scarce in non-ferrous metals. As exceptions, lead dropped 0.1c., to 2.9c., E. St. Louis, and tin, 2.27½c., to 19.6c., New York, during the week. Zinc, however, advanced 0.025c., to 2.8c., at E. St. Louis.

(All prices as of April 8, 1932)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$10@$11	$10@$11	$12.00
Buffalo, No. 2, Fdry., per gross ton	14@ 15	14@ 15	17.50
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.00	12.25
Furnace Coke — Connellsville, per net ton	2.25	2.25	2.50
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.25
Steel Shapes — Pittsburgh, base, per 100 lb.	1.50@1.60	1.50	1.65

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Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.

Chicago	4.62½	Cleveland	4.50	New York	4.75
Cincinnati	4.35	Detroit	4.00		

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Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Hot-rolled, No. 10	1.55	3.20	3.00	3.00
Hot-rolled, No. 24*	2.20	3.55	3.25	3.50
Galvanized, No. 24	2.85	4.10	3.75	4.00

*Annealed

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Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
		⅜	½	⅝	¾	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.80	3.60	3.60
Cold fin., round or hexagon	3.30	3.10	3.10
Cold rolled strips	4.95	5.95	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.55	3.50
Rivets	4.00	3.30	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel — Hot-rolled bars, base, Pittsburgh, 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on bolts (except stove), nuts and lag screws, mill lots 75%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y.	23.30
Copper, electrolytic, Conn	6.00
Copper wire, base, Chicago and Cleveland	8.62½
Copper wire, base, N. Y.	8.50
Lead, pigs, E. St. Louis	2.90
Tin, Straits, pigs, spot, N. Y.	19.60
Zinc, slabs, E. St. Louis	2.80
Prices following are in cents per lb., base, N. Y., Chi. and Cleve.:	
Brass rods, high	10.25
Brass sheets, high	12.50
Brass tubing, high	15.75
Copper, drawn round	12.87½
Copper sheets	15.37½
Copper tubing	14.87½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	29.00
Babbitt, com'l, intermediate grade	34.75
Babbitt, genuine, highest grade	43.50
Solder, bar	16.50
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.00	2.00	1.75
Light brass	1.50	1.25	1.37½
No. 1 rod-brass turnings	2.25	2.25	1.75
Heavy copper	4.00	3.25	2.50
Light copper	3.25	2.75	2.37½

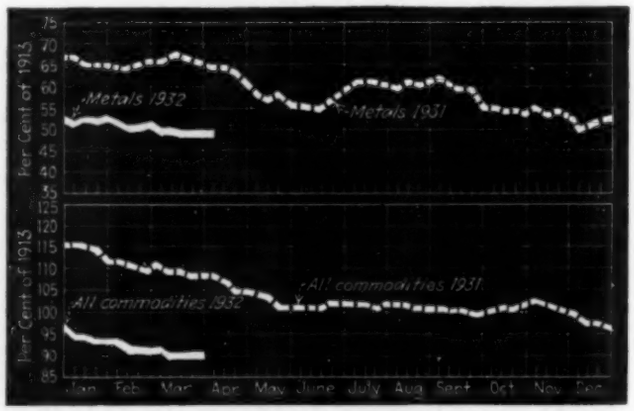
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	40–5%	40–5%	40–5%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60–10%

Lumber — Per M ft., b.m., 12–16 ft. lengths, delivered, N. Y.

Crating — Southern pine:
1x4-in., sq. ed. ..... $27.00 1x6-in. $24.00

Skids — Spruce:
2x4-in. .$35.00 3x4-in. .$35.00 4x6-in. .$37.00 6x6-in. .$50.00


Per Cent of 1913
Metals 1932
Metals 1931
All commodities 1931
All commodities 1932
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

Carbon Tool Steel Classification of Extras

All Dimensions Inclusive

Intermediate Sizes Take Next Higher Extra

ROUND, SQUARE AND OCTAGON

⅝ inch to 2 inches, inclusive..... Base

Inches	Extra per Lb. Cents	Inches	Extra per Lb. Cents
⅛	18.0	⅝ to 2	Base
7/32	10.0	2⅛ to 3	1.0
3/16	5.0	3⅛ to 4	1.5
¼ and 5/32	3.0	4⅛ to 5	2.0
7/32 and 11/32	2.0	5⅛ to 6	2.5
¾ to 13/16	1.0	6⅛ to 7	3.0
½ to 9/16	0.5	7⅛ to 8	3.5

FLAT

1/16 inch to 2 inches thick by ⅝ inch to 2 inches wide—Base

Inches	Extra per Lb. Cents	Inches	Extra per Lb. Cents
⅛ x 1/16	20.0	1/16 x ⅜ to ⅝	1.5
⅛ x ¼	15.0	1/16 x 11/16 to 8	1.0
⅛ x 1/16	8.0	⅜ x 7/16 to 8	1.0
⅛ x ⅜	4.0	7/16 x ½ to 8	1.0
⅛ x 7/16 to ½	3.0	½ x 9/16 to 8	1.0
⅛ x 9/16 to 7	2.0	9/16 x 2⅛ to 8	1.0
⅛ x 7⅛ to 8	3.0	9/16 to 2 x ⅝ to 2	0.0
1/16 x ¼	5.0	⅝ to 2 x 2⅛ to 7	1.0
1/16 x 1/16	4.0	⅝ to 1¾ x 7⅛ to 8	1.0
1/16 x ⅜	3.0	1⅞ to 2 x 7⅛ to 8	1.5
1/16 x 7/16 to ⅝	2.0	2⅛ to 3 x 2⅛ to 5	1.0
1/16 x 11/16 to 2	1.5	2⅛ to 3 x 5⅛ to 8	1.5
7/16 x 2⅛ to 7	1.0	3⅛ to 4 x 3⅛ to 6	1.5
7/16 x 7⅛ to 8	2.0	3⅛ to 4 x 6⅛ to 8	2.0
¼ x 1/16 to ⅜	2.0	4⅛ to 5 x 4⅛ to 7	2.0
¼ x 7/16 to ⅝	1.5	4⅛ to 5 x 7⅛ to 8	2.5
¼ x 11/16 to 2	1.5	5⅛ to 6 x 5⅛ to 8	2.5
¼ x 2⅛ to 7	1.0	6⅛ to 7 x 6⅛ to 7	3.0
¼ x 7⅛ to 8	2.0	6⅛ to 8 x 7⅛ to 8	3.5

Cutting to Specified Single and Multiple Lengths

	Extra per Lb. Cents
24 inches to 18 ft	0.5
18 to 24 inches	1.0
12 to 18 inches	1.5
6 to 12 inches	2.0
5 to 5 11/16 inches	3.0
4 to 4 11/16 inches	4.0
3 to 3 11/16 inches	5.0
2 to 2 11/16 inches	6.0
1 to 1 11/16 inches	8.0
Under 1 inch	10.0

FORGED DISKS AND DIE BLOCKS

To the base price of the steel used add the following extras:

	Die Blocks per Lb.	Disks per Lb.
Over 25 lbs. weight	2c.	3c.
15 lbs. to 25 lbs	3c.	5c.
10 lbs. to 15 lbs	5c.	6c.
7½ lbs. to 10 lbs	7c.	7c.
5 lbs. to 7½ lbs	8c.	8c.
3 lbs. to 5 lbs	9c.	9c.
2 lbs. to 3 lbs	11c.	11c.
1 lb. to 2 lbs	12c.	12c.
Under 1 lb. weight	Special Price	

ANNEALING..... 1c. per lb. extra

QUANTITY EXTRAS

These extras are applicable to individual items of a size ordered at one time for delivery at one time.

300 lbs. and over	Base
201 lbs. to 299 lbs	Add 0.5 cent per lb.
101 lbs. to 200 lbs	Add 1.0 cent per lb.
51 lbs. to 100 lbs	Add 2.5 cents per lb.
26 lbs. to 50 lbs	Add 3.5 cents per lb.
25 lbs. and under	Add 5.0 cents per lb.

BILLETS

Billets 2 inches square and larger, 15% less than bar base price plus extras for annealing, cutting and quantity.

Billets smaller than 2 inches square take bar base price plus extras for size, annealing, cutting and quantity.

High Speed Classification of Extras

All Dimensions Inclusive

Intermediate Sizes Take Next Higher Extra

ROUND, SQUARE AND OCTAGON

5/8 inch to 2 inches inclusive ..... Base

Inches	Extra per Lb. Cents	Inches	Extra per Lb. Cents
1/4 to 3/32	8.5	3 5/8 to 4	3.5
5/16 to 11/32	6.0	4 1/8 to 4 1/2	4.0
3/8 to 7/16	3.5	4 5/8 to 5	4.5
1/2 to 9/16	2.0	5 1/8 to 5 1/2	5.0
2 1/8 to 2 1/2	2.0	5 5/8 to 6	5.5
2 5/8 to 3	2.5	6 1/8 to 6 1/2	6.0
3 1/8 to 3 1/2	3.0	6 5/8 to 7	6.5

FLAT

5/8 inch to 2 inches thick by 5/8 inch to 2 inches wide ..... Base

Inches	Extra per Lb. Cents	Inches	Extra per Lb. Cents
1/8 x 3/16	40.0	3/8 x 1 5/8 to 5	2.5
1/8 x 1/4	30.0	7/16 x 1/2 to 1	3.0
1/8 x 5/16	20.0	7/16 x 1 1/8 to 5 1/2	2.5
1/8 x 3/8 to 2	14.0	1/2 x 5/8 to 1	2.5
3/16 x 1/4 to 3	14.0	1/2 x 1 1/8 to 6	2.0
1/4 x 1/16 to 1/2	8.0	5/16 x 5/8 to 1	2.5
1/4 x 5/8 to 1	5.0	7/16 x 1 1/8 to 6	2.0
1/4 x 1 1/8 to 4	3.0	5/8 to 2 x 5/8 to 2.	0.0
5/16 x 3/8 to 5/8	5.0	5/8 to 2 x 2 1/8 to 4.	2.0
5/16 x 3/4 to 1	3.5	5/8 to 2 x 4 1/8 to 7.	4.0
5/16 x 1 1/8 to 4 1/2	3.0	2 1/8 to 3 x 2 1/8 to 4.	2.0
3/8 x 1/16 to 3/4	3.0	2 1/8 to 3 x 4 1/8 to 7.	4.0
3/8 x 7/8 to 1 1/2	3.0		

Cutting to Specified Single and Multiple Lengths

	Per Lb. Cents
24 inches and over	1.0
18 to 23 15/16 inches	2.0
12 to 17 15/16 inches	3.0
6 to 11 15/16 inches	4.0
5 to 5 15/16 inches	6.0
4 to 4 15/16 inches	8.0
3 to 3 15/16 inches	10.0
2 to 2 15/16 inches	12.0
1 to 1 15/16 inches	16.0
Under 1 inch	20.0

FORGED DISKS AND DIE BLOCKS

	DISKS Extra per Lb. Cents	DIE BLOCKS Extra per Lb. Cents
Weighing above 25 pounds	6	4
Weighing 15 to 25 pounds	10	6
Weighing 10 to 15 pounds	12	10
Weighing 7 1/2 to 10 pounds	14	14
Weighing 5 to 7 1/2 pounds	16	16
Weighing 3 to 5 pounds	18	18
Weighing 2 to 3 pounds	22	22
Weighing 1 to 2 pounds	24	24

ANNEALING ..... 2c. per lb. extra

Bevels, same Classification as flats, plus 10c. per lb. for shape.

QUANTITY EXTRAS

These extras are applicable to individual items of a size ordered at one time for delivery at one time.

300 lbs. and over	Base
201 to 299 lbs.	Add 1 cent per lb.
101 to 200 lbs.	Add 2 cents per lb.
51 lbs. to 100 lbs.	Add 5 cents per lb.
26 lbs. to 50 lbs.	Add 7 cents per lb.
25 lbs. and under	Add 10 cents per lb.

BILLETS

Annealed Billets 2 inches square and larger, 15% less than bar base price plus extras for cutting and quantity.

Billets smaller than 2 inches square take bar base price plus extras for size, annealing, cutting and quantity.

Manufacturers Have Important Stake in Government Economy Measures

Business Looks to Senate, House and Hoover for Federal Cost Cutting—Reduced Expenses Are Preferred to Increased Taxes

AFTER their own experiences in trimming operating costs, manufacturers are watching with interest the government's effort in the same direction. This interest is more than academic since the tax burden will depend directly on the amount that can be cropped from Federal expense. Besides, it is generally felt that while the tax bill hangs fire, financial interests will be unwilling to make important commitments. A definite plan to reduce government expenditures will simplify budget balancing, speed the tax bill, and remove one of the many uncertain factors now disturbing business.

The first meeting between President Hoover and the House Economy Committee definitely established much ground in common and paved the way for legislative and other proposals that will be needed to carry out the tentative program. The President entered into spirit of economy by offering to take a $74,999 cut in his own salary, putting himself on a dollar-a-year basis. Other salary reductions for the Cabinet and Congress are planned.

Over $10,000,000 would be saved by a one-year suspension of extra overtime pay and automatic promotion for civilian employees as now provided by law. Naval land stations not essential to national defense are to be weeded out by a board of naval officers. Payments to states under the Federal Board for Vocational Training, except those for industrial rehabilitation, may be stopped with an estimated saving of $8,500,000. Transfer of the cost of the Philippine Scouts to the Island government would net another $5,000,000. Suspending for one year the operation of all Shipping Board lines would lop off an additional $7,500,000. General Hines advocated amendments to veterans' legislation calculated to save from $39,000,000 to $80,000,000.

As in similar action by private business interests, the problem of wage reduction involves the greatest controversy. After its repeated pronouncements favoring a retention of wage levels, it is a bitter pill for the Administration to sponsor any reductions. But popular opinion is that Federal employees should share the general reduction of income felt by most individuals outside the government service.

The administration group proposes a five-day week for day workers and a plan of furloughs without pay to stagger the services of annual employees. For this arrangement is claimed the advantage of keeping the maximum number of trained workers on the government payroll. Superannuated employees would be retired. Sick leave and vacations with pay would be limited to two weeks per year. Allowances to mail carriers for maintenance of vehicles would be suspended for one year.

The Economy Committee suggests in lieu of this program an 11 per cent pay cut with $1,000 exemption and the doing away with the Saturday half holiday. In either scheme, some flexibility would be given department heads by authorization with the approval of the Director of the Budget to transfer some percentage of specific appropriations to other uses. The purpose is to effect a large decrease in deficiencies.

Already the opposition has organized. Congressman La Guardia, recently active in the House defeat of a general sales tax, leads a general protest against the contemplated governmental wage cuts. Representative McDuffie, chairman of the House Economy Committee, expressed fear that the President's furlough plan might lead to favoritism.

One phase, especially important to business interests, is that this action offers an unusual opportunity to eliminate overlapping Federal functions and to consolidate the many unnecessary bureaus and commissions. The growth of repetitious activity flourishes in boom years and is ordinarily practically impossible to check. A critical period is necessary to effect a thorough-going housecleaning and to put the national government on a businesslike basis.

Auto Drive Aids Industry

Large orders of steel have been reported released by Ford and other automotive interests within the past week for early shipment. These releases have quickened operations in sheet mills near and about Detroit, and have probably been responsible for the resumption of operation at Republic Steel Corp. Niles plant last week. Deliveries of the new Ford V-8 to buyers are expected to begin in about a week. Ford dealers had about 200,000 orders for the new car on hand at the close of the first day's showing. Latest reports moved this figure above the 300,000 mark. These figures include orders taken before the cars were exhibited. Although somewhat limited at first, the production lines at Ford plants are reported to be filling up rapidly and it should only be a matter of days before large output is attained. Ford is expecting to turn out 4,000 cars a day by the latter part of April. More than 3,000 men are now employed in the Ford plant at East Windsor, Ontario. Chassis and bodies are coming through smoothly but the new eight-cylinder motor is said to have caused a bottleneck in the production program.

The Budd Wheel Co., Philadelphia, lately announced the receipt of important orders to be filled during April and May, and reverberations of automotive activity are also reported from New England. Briggs Mfg. Co., Detroit, has received an order for open bodies from Hudson-Essex in addition to those previously received from Ford and Plymouth.

Protest House Tax On Auto Sales

Protests against the House excise taxes on the automotive industry will be heard Monday, April 18, by the Senate Finance Committee. According to the Senate plan only one representative will appear for the automobile manufacturers. George C. Graham, vice-president of Rockne Motors Corp. will probably represent the industry. Parts and accessories manufacturers are also joining in the chorus of complaints against the action of the House.

U. S. Announces Machinery Purchases

Machinery purchases recently announced by the Government for Navy Yard and other government shops are as follows: One drop forge hammer, Chambersburg Engineering Co.; eight turret lathes, Jones & Lamson Machine Co.; one planer, Buss Machine Works, Holland, Mich.; one drill, Tidewater Supply Co., Inc.; one screw-cutting lathe, Rivett Lathe & Grinder Corp.; welding outfit, Westinghouse Electric & Mfg. Co.; a pipe threading and cutting machine, Warner-Dessan Inc., New York.

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The proposed revision of Simplified Practice Recommendation R45-28 (Grinding Wheels) is announced by the Simplified Practive Division, Department of Commerce.

BUSINESS ITEMS

Watson-Stillman Co., Roselle, N. J., builder of hydraulic machinery and accessories, has appointed Spalding Machinery Co., Inc., Engineering Bldg., 205 W. Wacker Drive, Chicago, Ill., as sales representative in the Chicago territory.

Hollup Corp., Chicago, opened a Pacific Coast factory at 5701 Green St., Emeryville, Calif., on Apr. 1, for the manufacture of welding machinery, electrodes and accessories for Pacific Coast distribution.

Operations of Vanadium Alloys Steel Co. and its subsidiary Colonial Steel Co., have been combined and centered at the Vanadium plants, Latrobe, Pa. The Colonial Steel Co. plant at Monaca, Pa., will be closed on completion of current orders and will remain idle for an indefinite period. No machinery or employees will be transferred to Latrobe. Business of the combined companies will be carried on under the name of Vanadium Alloys Steel Co., with principal offices at Latrobe and sales offices at Pittsburgh, Pa.

Jaeger Machine Co., Columbus, Ohio, has called a special meeting of stockholders to vote on the proposed sale of its Duplex foundry division, Elyria, Ohio, to LLOYD BROWN, chairman of the board.

Roe Machine Shop, Cassville, Wis., completely equipped, has been purchased by CLYDE CLAUER, Beetown, Wis., who will continue its operation.

Lincoln Electric Co., Cleveland, O., has appointed La Consolidada, S. A., Mexico, D. F. as Mexican distributors of Lincoln welding supplies and motors.

Altorfer Bros. Co., Peoria, Ill., manufacturer of washing machines is to establish a branch plant on Notre Dame St., Montreal, Can.

A loan of $7,173,000 through the Reconstruction Finance Corp., has made it possible for Wabash Railroad to return 1,100 men to work at the road shops, Decatur, Ill. WALTER S. FRANKLIN, president, has announced plans for steady shop work for some time.

Rumors of extensive reorganization at the Delco plant, Rochester, are denied by JOHN L. PRATT, director and vice-president in charge of accessory and parts operation of General Motors Corp.

Taft-Peirce Mfg. Co., Woonsocket, R. I., has announced the appointment of ARTHUR H. HALL, 133 S. 36th St., Philadelphia, Pa., as sales representative in that territory. Mr. Hall was formerly sales manager of Hendey Lathe.

Reports that the Meadville, Pa. shops of Erie railroad will be closed are officially denied by C. E. DENNY, president.

John Van Range Co., Cincinnati, manufacturer of ranges, hotel and kitchen equipment, has been purchased at a receiver's sale by interests identified with Edwards Mfg. Co.

Charles E. Dufur Co., 403 N. Paca St., Baltimore, wire and iron works, has been taken over by Chester L. Bowser, who will operate the business at the same location and under the old name. Transfer includes all machinery and equipment.

The manufacturing division of the B. Hoffmann Mfg. Co., 1819 West St. Paul Ave., Milwaukee, maker of plumbers' and steamfitters' supplies and materials, has been purchased by H. A. SCHAUER who will continue the business as the Hasco Valve & Machine Co. in its present quarters.

Cincinnati Ball Crank Co., Oakley, O., manufacturer of automobile service-station equipment, has acquired Brookins Mfg. Co., Dayton, Ohio, manufacturer of oil-measuring equipment. The Dayton factory is to be dismantled and brought to Cincinnati, where it will be combined with the Oakley factory.

Chrysler has licensed Societe Anonyme Citroen to produce and install Chrysler patented floating engine mountings on Citroen cars manufactured in France or assembled in the company's European plants.

American Bridge Co. plant, Elmira, N. Y., will close May 1 for about six months.

Reading (Pa.) Brass Works has gone into receivership. GEORGE C. K. MORRIS has been named receiver. Assets are listed at $23,500 and liabilities at $35,297.

Stockholders of Packard Electric Co., Warren, Ohio, ratified sale of the company to General Motors Corp. on the basis of one share of General Motors for each three shares of Packard Electric. The sale will be consummated May 1 when General Motors will take over the property. N. A. WOLCOTT, president of Packard, will become general manager, and the plant will continue operations. It is now being operated on a 50 per cent basis.

The recently organized Springfield (Mass.) Aircraft, Inc. has started work on its first order, a special two-place plane. The design follows somewhat the new racing ships worked out by ROBERT L. HALL, president and chief engineer of the company.

Norma-Hoffman Bearings Corp., Stamford, Conn., manufacturer of ball, roller and thrust bearings, has announced removal of its New York sales office, April 15, from Grand Central Terminal to the Commerce Building, 155 E. 44th St., N. Y.

Geometric Stamping Co., Cleveland, O., has appointed E. F. WILMOT, 62 Ridgemont St., Boston, and H. A. BELL, Third National Bank Building, Dayton, district representatives in the Boston and Dayton-Cincinnati districts respectively.

B. C. Ames Co., Waltham, Mass., manufacturer of micrometer dial gages and precision machinery, has moved its Detroit office to Michigan Theatre Building, Bagley and Clifford Streets. The office is in charge of EDWARD D. HAGGERTY.

Durant Motor Car Co., Elizabeth, N. J., has been ordered to show cause why a receiver should not be appointed.

Napier & Son, Ltd., Acton, London, has announced that it will reenter the automobile business.

H. A. Wilson Co., Newark, N. J., has undertaken manufacture of tungsten contacts, rivets and screws for electrical contact material and has also developed a Rhodium planting solution bath for coating contact metals with a hard acid and corrosion-resisting covering.

Tell Boys About Engineering Fields

In an effort to steer into the engineering field boys who are naturally adapted to that work, as well as to steer away those who are not, the Education Research Committee, Engineering Foundation, 29 W. 39th St., New York, is preparing a comprehensive pamphlet on engineering covering briefly all its broader varieties, to be printed by July 1. A large quantity of these pamphlets will be provided so that they may be distributed all over the country. They will be sold at a small price per copy.

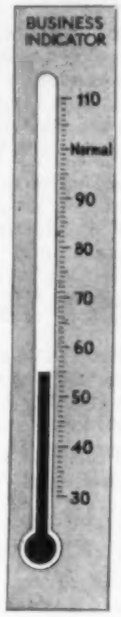
Members of the Education Research Committee nominated by the Engineering Societies and appointed by the Engineering Foundation include HARVEY N. DAVIS, chairman, president, Stevens Institute of Technology, representing the A.S.M.E.; WALTER F. WHITTEMORE, representing A.S.C.E.; WILLIAM B. PLANK, representing A.I.M.E.; WALTER S. RODMAN, representing A.I.E.E.; R. I. REES, representing S.P.E.E.; ALFRED H. WHITE, representing A.I.C.E.; and ALEXANDER R. STEVENSON, JR., member-at-large.

Statements for each of the broad divisions of engineering have been drafted by members of the committee and a number of other persons designated by the societies. They have been critically reviewed by the committee and the authors. These materials are being assembled by an editor, who is also writing a general chapter and an appendix. The committee chose as editor an engineer with long and varied experience in writing and keen interest in vocational selection. He is D. H. KILLEFFER, contributing editor of "Industrial and Engineering Chemistry." On literary style, the committee has the advice of JAMES T. GRADY, School of Journalism, Columbia University.

THE BUSINESS WEEK

April 13, 1932

The second quarter began by establishing new lows in basic business indicators, security markets and commodity price levels . . . The automobile sales drive has not yet been reflected in expansion in steel production or electric power output, while unseasonally declining merchandise carloadings and bank debits indicate further recession in retail trade . . . Building construction seems to be stabilizing at bare subsistence levels . . . Budget balancing has not proven as much of a blessing as was anticipated, and some of the taxes employed for the purpose have stimulated sabotage and short-selling in security markets . . . Extension of federal credit relief into the mortgage field, and widespread forced sales of farm land show the spread of deflation . . . Bank credit contraction continues despite increased liquidity . . . Reconstruction Corporation activity has reduced bank suspensions and individual hoarding but increased bank hoarding . . . Federal Reserve pressure for credit expansion is still inoperative, and its powers under the Glass-Steagall bill are still unused . . . Unless an effective inflationary movement can be initiated some form of standstill on domestic debts seems inevitable . . . Cooperative efforts to prevent breakdown in Eastern Europe are hopeful, but are complicated by the inconspicuous and disguised extension of moratoria on external payments by Germany . . . Improvement in Britain under a modified gold standard persists in spite of speculative pressure to raise sterling.



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Soviet Industries Run Into Trouble

As one huge Soviet project, the new steel plant at Kuznetsk, Siberia, opens operations, several others find themselves in difficulties, according to cable reports to the *New York Herald Tribune* and other newspapers. The Freyn Engineering Co., Chicago, recently received advices from Siberia stating that the first blast furnace in the new steel plant for the Soviet Steel Combine was producing for the first time. The plant is designed for an ultimate annual capacity of more than 1,000,000 tons, according to the engineers for the project.

Seventeen engineers and foremen from Ford plants in the United States have arrived at Nizhni-Novgorod and are endeavoring to straighten out the huge Soviet-Ford plant in that city. Production has fallen so far behind schedule that complete reorganization was ordered by the Central Committee of the Communist party.

Soon after news of the Nizhni-Novgorod automobile plant difficulties reached this country, there came also information that the Amo plant at Moscow and the tractor plants at Stalingrad and Kharkov are faced with a possible stoppage of production which can be avoided only by emergency measures to develop the machine building industry. Shortage of metals is another cause of trouble. Russian papers say that the heavy machinery of the plants in question is suffering abnormally from wear and tear, and that when a breakdown occurs it is impossible to make proper repairs owing to the lack of spare parts. For instance, during the final quarter of 1931, from two to eight pneumatic hammers at Stalingrad were constantly idle because of the difficulty of making repairs promptly.

The failure of the metal supply has apparently come about through the failure of the coal industry to carry out its production plan. Inefficient organization of labor was said to have caused a drop in the daily coal production of the Donetz Basin from 140,000 tons in January to 123,000 tons at the end of March. Confusion in the transportation system has been another cause of difficulty.

Possible return of Russia to the United States as a source of supply for machinery may be found in the fact that a commission on construction of the Cheliabinsk tractor factory arrived in New York, March 24, with authorization to place orders for machinery and equipment totaling $2,500,000. It is reported that American business representatives in Moscow generally have found a somewhat more favorable attitude in recent weeks toward American trade. Soviet officials also have expressed unofficially a willingness to do business with Americans providing "reasonable" credit terms can be arranged.

To Memorialize Prof. A. J. Wood

Mechanical-engineering graduates of Pennsylvania State College are sponsoring a project to memorialize the late PROF. ARTHUR J. WOOD by having the mechanical-engineering laboratory at Penn State named the "Arthur J. Wood Memorial Laboratory." Much of the laboratory equipment pertains to railway-mechanical engineering and refrigeration, subjects in which Professor Wood was keenly interested and upon which he did considerable research.

• PERSONALS •

ARTHUR BENTLEY has been elected a director of American Steel Foundries, Chicago.

COL. J. S. ERVIN has been elected president of Mackintosh-Hemphill Co., Pittsburgh, manufacturer of rolling-mill machinery and steel plant equipment. He was formerly vice-president and sales manager of H. H. Robertson Co., Pittsburgh. F. HUGHES MOYER, recently president of Mackintosh-Hemphill Co., has been elected vice-president in charge of engineering, succeeding W. L. DITGES.

V. E. CLARK has been elected a director of Waco Aircraft Co., succeeding the late COLONEL THURMAN H. BANE.

JOSEPH E. OTIS, JR., vice-president and general manager of Alemite Corp., Chicago, has been elected a director of Stewart-Warner Corp., Chicago, makers of automotive accessories and electrical supplies.

GEORGE H. SCRAGG, a former executive of Mack Trucks, Inc., New York City, has accepted an executive position with Brockway Motor Truck Corp. in the same city.

WILLIAM G. MATHER, formerly president of Corrigan, McKinney Steel Co., Cleveland, Ohio, has been elected chairman of the board. DONALD B. GILLIES, vice-president, was elected president. Other officers remain the same.

H. E. FIELD, formerly president of Wheeling Mould & Foundry Co., Wheeling, W. Va., has been elected second vice-president of Mackintosh-Hemphill Co., Pittsburgh, Pa.

WARREN P. LOUDON, formerly president and general manager of Delco Aviation Corp., Dayton, Ohio, has been appointed assistant general manager of Pioneer Instrument Co., Brooklyn, N. Y.

CHARLES C. GIBSON has been elected president and chairman of the board of directors and general manager of Mullins Mfg. Corp., Salem, Ohio. CLIFTON REEVES has been elected vice-president and secretary; S. J. WATKINS, assistant secretary; E. S. ERICKSON, vice-president in charge of engineering; DODGE L. MARKS, vice-president; J. RHODES O'REILLY, assistant secretary; C. C. GIBSON, W. P. CARPENTER and R. F. WHITE, members of the executive committee.

WALTER J. CURLEY, Pittsburgh, has been elected a director of Hayes Body Corp.

Z. G. SIMMONS, president of Simmons Co., has been elected chairman of the board of that company, a newly created office. GRANT G. SIMMONS, secretary-treasurer and vice-president was elected president.

CHARLES D. TERRY, vice-president of Boss Mfg. Co., Kewanee, Ill., has recently been elected secretary and treasurer of the company.

HOWARD E. BLOOD, president of Detroit Gear & Machine Co., and of Norge Corp., has been elected first vice-president of Borg-Warner Corp., succeeding the late J. R. FRANCIS.

Production, Engineering

WILLIAM D. DRYSDALE is now chief engineer of Electric Devices, Buffalo, builder of household ice machines. He was formerly superintendent in charge of manufacturing and assembling for Whitehead Refrigeration Co., River Rouge, Mich.

HAMILTON GARNSEY, JR., has been appointed works manager of Goulds Pumps, Inc., Seneca Falls, N. Y.

I. N. HATCH, formerly in charge of assembly for Stutz Motor Car Co., Indianapolis, and later in charge of Stutz service in the Chicago territory, has been appointed service manager of Nash New England Co., Boston.

HENRY W. SWEET, formerly chief engineer of Krohn Differential Corp., Buchanan, Mich., is now connected with Auburn Automobile Co., Auburn, Ind.

ROBERT T. WALKER, assistant to WILLIAM B. MAYO, chief engineer of Ford Motor Co., and for many years associated with the airplane division of that company, has resigned after 18 years with the company.

CORNELIUS P. WHALEN has resigned as vice-president of Minerva Automobiles, Inc., New York City, and is now engaged in special research engineering work.

L. A. STEWART, production manager of Olds Motor Works division of General Motors, will also act as production manager of Buick, with complete charge of purchases. This function was formerly performed by R. L. KURTZ. FRANK D. ELWELL, formerly plant engineer for Olds, is now plant engineer for Buick, succeeding HOWARD MILLS, who becomes assistant plant engineer.

Sales

CHARLES M. REESEY, in charge of advertising for Cincinnati Milling Machine and Cincinnati Grinders Inc., has been elected secretary and treasurer of Cincinnati Association of Industrial Marketers, member of National Industrial Advertisers' Association.

ROBERT W. GRACE, formerly with Lake Shore Machinery Co., Muskegon, Mich., has been named representative at Muskegon for Cleveland Crane & Engineering Co., Wickliffe, Ohio.

J. MAX LEE, 114 West 17th St., Los Angeles, Calif., has been appointed sales representative in Southern California for Dings Magnetic Separator Co., Milwaukee, Wis.

FRANK A. FORD has been appointed sales representative of Goddard & Goddard Co., Inc., Detroit, for the northern half of Illinois, the northern section of Indiana, and all of Iowa. Mr. Ford is located in Room 2150, Daily News Building, 400 West Madison St., Chicago, Ill.

LEO AUMAN, sales department, American Metal Co. Ltd., New York, has resigned after nearly 21 years with that company.

F. J. DRUAR has been appointed assistant sales manager of Bower Roller Bearing Co., Detroit. He was previously sales engineer with Timken Roller Bearing Co., Canton, Ohio.

ROBERT S. BINKERD has succeeded ARCHIBALD H. EHLE as vice-president in charge of sales for Baldwin Locomotive Works, Eddystone, Pa.

Activities

CHARLES T. MAIN, consulting engineer, Boston, Mass., and past-president of American Society of Mechanical Engineers, has been given a diploma of honorary membership by the Boston Society of Civil Engineers.

W. E. BLEWETT, JR., assistant to the president, Newport News Drydock & Shipbuilding Co., Newport News, Va., was a speaker at the April meeting, New York Chapter, A.S.S.T., Apr. 11. His talk covered the development of materials of suitable strength per lb. of weight, resistance to fatigue, weldability, ease of working and forming, and corrosion-resistance of power units under high temperature.

JOHN M. CARMODY, editor of *Factory & Industrial Management*, will act as chairman of the Thursday morning session of the M-M-M Congress to be held in Detroit, May 4-5.

DR. WILLIAM E. WICKENDEN spoke recently on "The Economic Status of the Mechanical Engineer" before the Cleveland section of the A.S.M.E.

PROF. GEORGE F. BATEMAN has been placed in charge of the schools of engineering of Cooper Union with the title of Acting Dean, replacing the late DEAN FRANCIS M. HARTMANN, according to a recent announcement by R. FULTON CUTTING, president of the Union Board of Trustees.

SIR HENRY FOWLER, assistant to vice-president for research and development, Midland Railway Co., Derby, England, has been elected president of Institute of Metals, London.

CHARLES A. GILL, superintendent of motive power, Baltimore & Ohio Railroad Co., who returned in February of this year from a year's service in Russia as chief consulting engineer for the railroad system there, recently talked on "The Russian Situation as Observed by an American Railroad Man" before an A.S.M.E. section meeting in Baltimore, Md.

HUGH BENET, works manager, Worthington Pump & Machinery Co., Holyoke, Mass., was reelected president of the Western Massachusetts branch of National Metal Trades Association at its 28th annual meeting in Springfield, April 7.

ROBERT PIERCE, secretary-treasurer of Briggs Mfg. Co., sailed for England to supervise first production of Ford bodies in the new Briggs European plant at Dagenham, near London.

E. E. YAKE, vice-president, Worthington Pump & Machinery Corp., will be the speaker and W. L. BATT, president, S. K. F. Industries, Inc., the chairman at a joint meeting of the National Association of Cost Accountants, New York Chapter, and the American Management Association, New York Group, at Hotel Edison, 47th Street, New York, April 19.

U. S. C. of C. Meeting Set for May 17-20

The Twentieth Annual Meeting of the Chamber of Commerce of the United States will be held this year at San Francisco, May 17-20. The meeting will concern itself with the lack of an adequate statistical basis for estimating the volume and requirements of particular industries and with means for remedying this condition. A recent survey by a committee of the Chamber shows that 30 per cent of the trade associations in the field of manufacture and 54 per cent in the field of distribution carry on no statistical activities whatever.

• OBITUARIES •

CHARLES H. BELL, 59, inventor, and president of Bell Mfg. & Tool Co., died April 7, at Cleveland, O., after an illness of two years.

CLINTON B. BUCKINGHAM, 56, department superintendent of American Copper Products Corp., Elizabeth, N. J., died Apr. 1 in that city.

WALTER PECK BRYAN, 57, director of American Hardware Corp., Plume & Atwood Mfg. Co. and official of numerous other companies, died Apr. 1.

FRANCIS E. DRURY, 81, founder of Perfection Stove Co., Cleveland, died Apr. 3, at Augusta, Ga. He organized Cleveland Foundry Co. in 1888 with H. P. CROWELL. Shortly afterward he became interested in the oil stove and in 1910 organized Cleveland Metal Products Co. This concern became Perfection Stove Co. in 1924. Mr. Drury was chairman of the board until 1930 and a director until his death.

JOHN HERMANN, 74, president of Hermann Safe Co., San Francisco, died Apr. 1 in that city.

WILLIAM J. JACKSON, 73, former president of Chicago & Eastern Illinois Railroad who retired in 1925, died Apr. 4 of pneumonia at a hotel in Biloxi, Miss. Starting as an engine wiper and machinist helper on the Grand Trunk Railroad in Toronto in 1877, he had been superintendent, general manager and vice-president of the railroad before he became president in 1913.

GEORGE J. KUHRTS, 63, president and general manager of Los Angeles Railway Co., Los Angeles, died there Apr. 1.

CHARLES L. LAMARCHE, 75, president of American Malleable Castings Co., Marion, Ohio, died April 5 in that city. He organized the company in 1905.

AARON MANN, 40, president of Mann Iron & Steel Co., Norristown, Pa., died Apr. 2 from a nervous breakdown.

GEORGE NOWLAND, 39, president of George Nowland Corp., manufacturers' agent, New York, and former president of Manufacturers' Association of New York, died there Apr. 1.

JOSEPH F. PERAULT, 60, owner of Fitchburg (Mass.) Foundry Co., and Brown Engine Co., Fitchburg, died at his home in that city April 7 after an extended illness. He was also president of the New England Truck Co.

JOHN R. RUSSELL, 74, former president of Great Lakes Engineering Works, Detroit, and vice-president of Clayton & Lambert Mfg. Co., Detroit, died in that city Apr. 1.

MATTHEW BACON SELLERS, 63, authority on aerodynamics, died April 5, at his home in Ardsley-on-Hudson, N. Y. Mr. Sellers was technical assistant to SEC. OF NAVY JOSEPHUS DANIELS during the World War. He is said to have been the first to determine the lift and drift of arched surfaces by means of the wind tunnel.

EUSTACE SHORT, partner in the firm of Short Brothers, English airplane manufacturers, was found dead in his plane April 8 near Rochester, England.

N.M.T.A. Convention To Be Held April 20

The National Metal Trades Association will hold its 34th annual convention at Hotel Commodore, New York City, April 20. Topics to be considered are: Status of Credit and Recent Financial Developments, Unemployment Insurance, Recent Legislation and Legislative Tendencies, Necessity for Drastic Reductions in National and Local Government Expenditures, Significance of the Sino-Japanese Conflict, and Labor Management in the Future.

COL. ROBERT MCCORMICK, publisher of the *Chicago Tribune;* FRED I. KENT, Bankers' Trust Co., New York; PROF. R. S. MERIAM, Harvard School of Business Administration; HENRY SHARPE, Brown & Sharpe Mfg. Co., Providence, R. I.; DR. CHARLES PROSSER, Minneapolis; and JAMES A. EMERY, of Washington, will be the speakers. CONGRESSMAN JAMES M. BECK, of Philadelphia, will be the principal guest speaker at the annual banquet.

S.A.E. Summer Meeting June 12-17

The 1932 Summer meeting of the S.A.E. will be held at White Sulphur Springs, W. Va., June 12-17. CHAIRMAN N. G. SHIDLE and other members of the meetings committee are preparing the program. Sessions are being arranged by the various professional activities, and, in addition, standards, research and general topics will receive consideration. The latest developments in automotive engineering will be outlined and discussed, and arguments for and against the various points set forth by the authors are projected.

Patent Exposition In N. Y. May 10-28

The Fourth International Patent Exposition for the purpose of bringing inventors and inventions in contact with manufacturers will be held May 10-28, 1932, in Grand Central Palace, New York City. MAJ. GEN. GEORGE O. SQUIER, noted inventor and former head of the Air Forces, U. S. Army, is honorary chairman, and HERMAN LARSON is managing director.

A.S.T.M. Symposium On Steel Castings

A symposium of Steel Castings, sponsored jointly by the American Foundrymen's Association and the American Society for Testing Materials, will be a feature of the 35th Annual Meeting of the A.S.T.M. to be held in Atlantic City, June 20-24. This symposium will be the second of its kind, the first having been held at the 1931 annual meeting in Chicago. Plans for the symposium have been formulated by an Advisory Committee headed by W. C. Hamilton, research director, American Steel Foundries. Two sessions are contemplated in which the following papers will be presented.

FIRST SESSION

Introduction—W. C. Hamilton, American Steel Foundries.
Statistics Covering Steel Castings — Steel Founders' Society of America.
General Data on Steel Castings and Their Fields of Application Governed by the Various Physical Properties—C. E. Williams and C. H. Lorig, Batelle Memorial Inst.
Test Bar Specifications, Including the Relationship Between Physical Properties Obtained from Coupons and the Physical Properties of the Metal in the Castings —R. A. Bull, Electric Steel Founders' Research Group.

SECOND SESSION

Development of Alloy Steels for Castings:
(a) Pearlitic Steel Castings—Fred Grotts, Continental Roll and Steel Foundry Co.
(b) Iron - Chromium, Iron - Chromium-Nickel and Related Alloys—Data to be obtained from Committee A-10, A.S.T.M., Jerome Strauss, Vanadium Corp. of America.
(c) Austenitic Manganese Steel Castings —J. H. Hall, Taylor-Wharton Iron and Steel Co.
Problems in the Heat Treatment of Steel Castings—A. W. Lorenz, Bucyrus Erie Co.
Welding—T. S. Quinn, Lebanon Steel Foundry.
General Principles of Design as Related to Physical Properties, Soundness and Ease of Production—F. A. Lorenz, Jr., American Steel Foundries.

In addition to the symposium there have been planned three round-table discussions on the topic "Acquisition of Good Data."

• MEETINGS •

AMERICAN WELDING SOCIETY
Annual meeting, Hotel Pennsylvania, Bldg., New York, Apr. 27-29. William T. Spraragen, secretary, 29 W. 39th St., New York City.

AMERICAN MANAGEMENT ASSOCIATION
Annual meeting, Hotel Pennsylvania, New York, May 2, 1932.
Annual meeting, Institute of Management, Hotel Pennsylvania, New York, May 5, 1932. W. J. Donald, Managing Director, 20 Vesey St., New York, N. Y.

FOUNDRY AND INDUSTRIAL EXPOSITION
Also 36th annual convention, American Foundrymen's Ass'n, Hotel Statler, Detroit, Mich., May 3-5. C. E. Hoyt, manager, American Foundrymen's Ass'n, Inc., 222 W. Adams St., Chicago.

AMERICAN GEAR MANUFACTURERS ASS'N
Sixteenth Annual Meeting, Hotel Statler, Cleveland, Ohio, May 12-13. Executive Committee meeting, same place, May 11. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS
1932 summer meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., June 12-17. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS
Annual meeting, Atlantic City, June 20-24. R. E. Hess, assistant secretary, 1315 Spruce St., Philadelphia, Pa.

NATIONAL MACHINE TOOL BUILDER'S ASS'N
Third National Machine Tool Show, Cleveland (Ohio) Municipal Auditorium, Sept. 10-17. Boyd Fisher, general manager, 1415 Enquirer Bldg., 617 Vine St., Cincinnati, Ohio.

NATIONAL METAL CONGRESS & EXPOSITION
174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored by A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., and the Wire Association. W. H. Eiseman, 7016 Euclid Ave., Cleveland, Director.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Ariz., Miami — Miami Copper Co., F. W. Maclennan, Gen. Mgr., has work under way for construction of a 3,000 ton mill by day labor. $50,000.

Ariz., Prescott—National Exploration Co., W. W. Linesba, Gen. Mgr., plans construction of a new 150 ton mill and installing equipment, including crushers, ball mill, classifiers, thickeners and fitters, orebins, etc. Estimated cost $50,000.

Calif., San Francisco—Bethlehem Shipbuilding Corp., Ltd., 20th and Illinois Sts., plans construction of a warehouse, also miscellaneous shipping facilities at 18th and Illinois Sts. Estimated cost $750,000.

Conn., Groton — East Coast Ship & Yacht Building Co., c/o H. Morse, Noank, plans addition and alterations to ship building plant here. Estimated cost $40,000. Private plans.

Kan., Chanute—State Highway Commission, G. T. Helvering, Dir., will receive bids until April 15 for construction of a division shop building.

Kan., Salina—Dale C. Hudkins, 128 North Seventh St., will soon award contract for reconstruction of a 1 story, 100 x 120 ft. garage and sales room destroyed by fire. C. W. Shaver, 628 United Life Bldg., Archt. $15,000.

Mass., Peabody—John Meagher, 19 Gardner St., awarded contract for construction of a 1 story garage and showroom at 125 Lowell Road. Estimated cost $40,000.

Mass., Quincy (sta. Boston)—Standard Oil Co. of New York, Park Square Bldg., Boston, awarded contract for construction of a bulk oil storage and distribution building including garage, repair shop, office, docks, tanks, etc., here. Estimated cost $600,000 including equipment. Noted March 24.

Mass., Somerville—City, c/o J. J. Murphy, Mayor, awarded contract for construction of a 1 and 3 story police station and garage at Union Square. Estimated cost $250,000.

Mass., Weymouth—Crawford Machine Co., 16 Central Ave., South Weymouth, awarded contract for reconstruction of 2 story factory destroyed by fire. Estimated cost $50,000. Noted April 7.

Mass., Worcester — Sewer Department, c/o J. H. Brooks, Jr., will receive bids until April 15 for construction of a 3 story, 55 x 175 ft. work shop on East Worcester St. Estimated cost $40,000. R. C. Gorrani, 175 Green St., Archt.

Miss., Fernwood — Indianapolis Wire Bound Box Co., 1300 Beecher St., Indianapolis, awarded contract for construction of a 1 story, 150 x 200 ft. plant here. Estimated cost $50,000. Noted Mar. 24.

Mo., Kansas City—Benson Brass & Chandelier Works, E. B. Benson, V. Pres., 3888 East 63rd St., having preliminary plans prepared for rebuilding 2 and 3 story plant at 1417 Agnes St., destroyed by fire. Estimated cost $60,000.

N. J., Clinton—Starnas Bros., c/o Poggi & Bragdon, 275 Morris Ave., Elizabeth, Archts., receiving bids for construction of a 1 story garage and salesroom here. Estimated cost $40,000.

N. J., Eatontown—William Champlin, 6 Hunt St., Rumson, preliminary plans for a 1 story addition to repair shop and garage. Estimated cost $40,000. Private plans. Noted March 24.

N. J., Plainfield—Plainfield Lumber & Supply Co., 403 Brickman St., having preliminary plans prepared for a 1 story garage. Estimated cost $40,000. Private plans.

N. J., Teaneck — Owner, c/o George W. Swiller, 4215 3rd Ave., New York, N. Y., Archt., having plans prepared for construction of a 1 story, 100 x 100 ft. automobile repair shop, garage and laundry on Cedar Lane here. Estimated cost $50,000. Maturity after July 1.

N. M., Loving—United States Potash Co., 342 Madison Ave., New York, N. Y., will build a potash deposit works, shops, refinery, etc., here. Estimated cost to exceed $800,000. Work will be done by separate contracts.

N. Y., Malverne—School District 12, town of Hempstead, Lynbrook, plans an election April 18 to vote $345,000 for construction of a high school including shop, classrooms, administration building, etc., on Ocean Ave., here. F. P. Wiedersum, 240 Rockaway Ave., Valley Stream, Archt.

N. Y., Maspeth—Charles Hofsletter, 2273 41st St., Astoria, plans construction of a 1 story, 25 x 30 ft. automobile repair shop at 56th Road and 58th St. here.

N. Y., New York—Five Hundred Fourteen West 23rd St. Corp., 100 Southern Blvd., will receive bids about July 1 for construction of a 4 story, 98 x 122 ft. service garage. Estimated cost $150,000. R. G. Cory, 30 Church St., Archt. Noted January 28.

N. Y., New York—Magdalena Augoletti, 3829 Harper Ave., having sketches made for construction of a 1 story, 40 x 46 ft. service garage at Booton Road and Heath Ave. Private plans.

N. Y., New York—Two Streets Corp., A. O. Englander, Pres., 295 Madison Ave., having sketches made for converting building into service garage at 146 East 25th St. Estimated cost $40,000. Joseph Harrison, 220 East 42nd St., Archt.

N. Y., New York—William Peat, 2436 Grand Concourse, will receive bids after July 1 on general contract for a 2 story, 100 x 150 ft. service garage at 416 West 204th St. S. J. Kessler, 125 West 45th St., Archt. Noted March 31.

N. Y., Syracuse—Lowman Folding Box Co., 736 North Clinton St., acquired part of American Piano Co. plant and plans alteration and equipping for the manufacture of fibre containers. Estimated cost $40,00 including equipment.

N. Y., White Plains — Westchester Airport Association, J. S. Reaves, Secy., Rye., having plans prepared for construction of an airport including hangars, repair facilities, etc., near here.

Okla., El Reno—Bureau of Prisons, Department of Justice, Washington, D. C., plans construction of a 2 story industrial shop, power house and laundry building at Southwestern Reformatory near here. Estimated cost $150,000.

Pa., McKeesport—J. Guttman, 6335 Phillips Ave., Pittsburgh, receiving bids for construction of a 1 story, 15 x 105 ft. service station at Ninth, Market Sts. and Strawberry Way here. Alexander Sharove, Berger Bldg., Pittsburgh, Archt.

S. C., Columbia—State Prison, J. N. Pearman, Supt., plans to rebuild ten workshop buildings destroyed by fire. Estimated cost $150,000.

Utah, Sigurd—Jumbo Plaster Mill, c/o J. Greenwood, Salt Lake City, Dir., awarded structural steel contract for rebuilding gypsum mill destroyed by fire. Estimated total cost of mill and installation of machinery $250,000. Noted March 10.

Va., Alexandria — Ford Motor Co., 3674 Schafer Road, Dearborn, Mich., awarded general contract for construction of a 1 and 2 story automobile assembly plant including distribution and service building, enameling department, loading dock, etc., here. $500,000. Noted April 7.

Va., Brookneal—C. J. Wheelbarger, Dayton, Va., and J. H. Burruss, of Burruss Land and Lumber Co., Lynchburg, have presented to Town Council of Brookneal plans for a furniture factory to be constructed here as soon as arrangements can be perfected. The plant is to be operated by Mr. Wheelbarger, who has been engaged in the woodworking manufacturing business many years.

Va., Rocky Mount — Bald Knob Furniture Co., plans to rebuild part of plant destroyed by fire. Estimated cost to exceed $40,000. Maturity indefinite.

Equipment Wanted

Ariz., Phoenix — Superintendent Phoenix Indian School—will receive bids until April 18 for one direct motor driven single surfacer.

Calif., San Diego—Bureau of Yards & Docks, Navy Department, Washington, D. C.—will receive bids until April 19 for one valve refinishing machine for Navy Yard here.

D. C., Washington—Bureau of Yards & Docks, Navy Department—will receive bids until April 26 for motor driven milling machine and attachments for Navy Yards, New York and San Francisco. Sch. 7813.

Mo., Valley Park—Barbour Boat Works—three-jawed Independent chuck, 8 to 12 in., also polishing lathe.

N. Y., Brooklyn—Bureau of Yards & Docks, Navy Department, Washington, D. C.—will receive bids until April 19 for 26 electric arc-welding sets. Sch. 7800.

Tex., San Antonio—Purchasing & Contracting Officer, Normoyle, Quartermaster Depot, will receive bids until May 20 for one portable motor driven arc welding set and brake turning lathe, motor driven. Cir. 2.

Va., Alexandria — Ford Motor Co., 3674 Schafer Road, Dearborn, Mich.—complete assembly line equipment and conveyors in connection with proposed 1 and 2 story automobile assembly plant. Estimated cost $500,000.

Ont., Milton—Milton Wood Products Ltd., A. H. Cropps, Mgr.—equipment for the manufacture of wood products, hocky sticks, etc., for recently acquired premises on Commercial St.

Que., St. Malachie—Ernest Tanquay—machinery and equipment for proposed sawmill. Estimated cost $25,000.